news, knowledge, advice

SCIENCE DIGEST

MARCH 1967 • 50 CENTS 1.00

A TRIBUTE
GUS GRISSOM
ED WHITE
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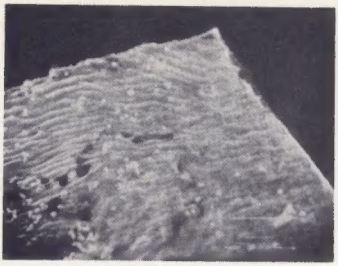

A

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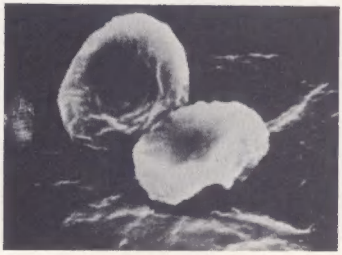
C



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Application of the scanning electron microscope has broadened since it was discovered recently that a living organism, the flour beetle, can survive the instrument's vacuum and intense radiation.

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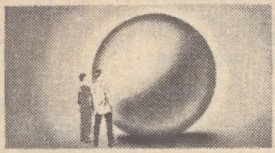

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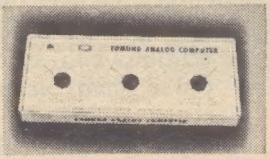

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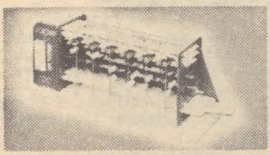

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EVERY now and then, a breath of fresh scientific air unexpectedly flies in over the transom—something light, whimsical, but nonetheless with serious overtones if you're sharp enough to single them out. It relieves the hard science we deal with daily.

Harold Dunn, who first queried us with a story suggestion three years ago, is back again in this issue (page 61) with another delight-

THIS MONTH

ful article on the funny way school children express themselves. This time it's on science papers ("Naughtical miles tell how far it is to places we shouldn't go")!

Some quotes are hilarious; most are zany; all are highly original. So is Mr. Dunn's research. He has been a grade school teacher in Kirkwood, Mo., for a dozen years. He has three books under his belt. The two most recent: *Those Crazy Mixed-up Kids* (Signet, 1961) and *Kids Sure Rite Funny* (Bernard Geis, 1962). The latter was written in collaboration with Art Linkletter. In addition, Mr. Dunn has expounded on his moppets and their unique expressions in articles appearing in some 14 magazines over the years.

We are glad to have him aboard, and are sure that you will get as big a "charge" out of our future scientists' malapropisms as we did.

Don't miss the shrewd insights.

—THE EDITOR

news, knowledge, advice

SCIENCE

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DIGEST

Virgil (Gus) Grissom was one of America's first space age heroes. Now along with Ed White and Roger Chaffe he has become one of the first space age casualties. A tribute to these three brave men begins on page 9.
NASA photo

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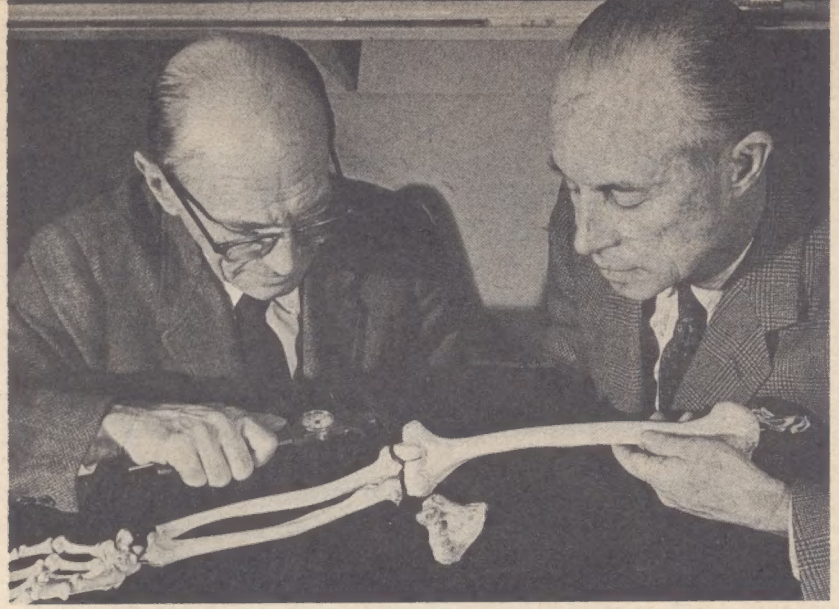
THE LATE SCIENCE NEWS

SHAKE-UP FOR RELATIVITY. Prime prop for Dr. Albert Einstein's theory of relativity may have had the rug pulled out from under it by Dr. Robert H. Dicke of Princeton. Using an optical device employing a notched rotating disc, Dr. Dicke has determined that the sun is not a perfect sphere. As the disc whirled, light from the sun's rim passing through the notches varied to a degree measurable by photocell, thus proving that the solar orb is out of round. Effect is enough, says Dr. Dicke, to explain orbital aberrations of Mercury on which Einstein based his theory. If Dicke is right, some conclusions based on relativity may undergo catastrophic revision. (See Science Digest next month for a graphic explanation of what this can mean to science).

SATURN'S TENTH. A French astronomer has discovered a tenth moon orbiting the planet Saturn. The moon is orbiting close to the outer edge of the planet's famous rings, and because of their brilliance they had obscured the object except under very unusual conditions. The moon orbits Saturn every 18 hours, has a diameter of 100 to 200 miles.

DEEPER AND BIGGER. Both the U.S. and the Soviets are busily digging deeper and bigger holes in which to test larger atomic devices. The reason for all the testing activity is that both nations seem to be rushing development on a warhead for an antimissile missile. This indicated a new and potentially dangerous arms race spiral.



IMPORTANT FIND. A 2.5-million-year-old piece of the upper arm bone of a man-ape from Kenya, Africa, sits next to the complete arm skeleton of a modern man. The fossil, representing the oldest Pleistocene member of the human family yet found, was discovered by Harvard's Prof. Bryan Patterson (left) a vertebrate paleontologist. Prof. William Howells (right), an anthropologist, aided in assigning the fossil to the line of early man-apes leading directly to the development of modern man.

RONGO-RONGO MYSTERY. In 1958 a German anthropologist announced that he had been able to decipher the perplexing rongo-rongo writing of Easter Island. Now new studies by Norwegian and Soviet authorities indicate that the strange writing is as mysterious as ever, and that German translations are meaningless. All knowledge of Rongo-Rongo as well as most of the inhabitants of Easter Island were wiped out by disease, slave raiders and missionary zeal.

BLUE WHALE HAS A CHANCE. After hunting the blue whale to the very edge of extinction man has decided to give it a chance to survive by putting a total ban on hunting the species. The blue whale is the largest creature that has ever lived, some of them growing 100 feet long and weighing from 125 to 150 tons. There are estimated to be only 600 of the gigantic whales left.

WHEN TO KILL BUGS. After spraying 20,000 houseflies and 4,000 roaches Dr. William N. Sullivan of the Department of Agriculture decided that they were most susceptible to insecticides around 4 p.m. Just why the spray is most effective then is unknown but experiments have indicated that insects have a rhythmical variation in their susceptibility to chemical insecticides.

SEAL MYSTERY SOLVED. Explorers have run across seal skeletons or mummified bodies of seals in Antarctica's dry, ice-free, upland valleys, as much as 35 miles inland. Many of the mummy seals were very old and the mystery was how did they get there. Now scientists have discovered a recently dead seal in the same area and have determined that an occasional seal becomes disoriented and begins crawling inland until it dies of exhaustion or starvation.

CHEROKEE ARCHAEOLOGY. The largest archaeological project in the United States during 1967 will take place this summer 10 miles west of Pickens South Carolina. It is the site of historic villages of the Cherokee Indians. The site is soon to be flooded by the waters from a new dam.

ACTIVITY AND SMOKING. The smoker who just sits around has a much greater chance of suffering a heart attack than the smoker who is moderately active. If the smoker does suffer an attack his chances of survival are twice as good if he had been physically active. These were some of the conclusions of a study of 55,000 men conducted by the U.S. Public Health Service.

STUDENTS AND SMOKING. College freshmen with bad grades and more spending money than average are more likely to smoke than poor but bright students. Smokers are also found more frequently among those freshmen who do not participate in campus activities.

GAS CLEARS ARTERY. Surgeons have successfully cleared a blocked heart artery with a high-powered jet of carbon dioxide. It is hoped the technique can be widely useful in clearing arteries choked by atherosclerosis, or hardening of the arteries.

DRINKERS GET MORE COLDS. "If a person drinks and is exposed to bacteria, he is more susceptible (to colds) than someone who doesn't drink," says Dr. Donald B. Louria of the Cornell Medical School. Why? Alcohol impedes the movement of white blood cells a major line of defense against infection.

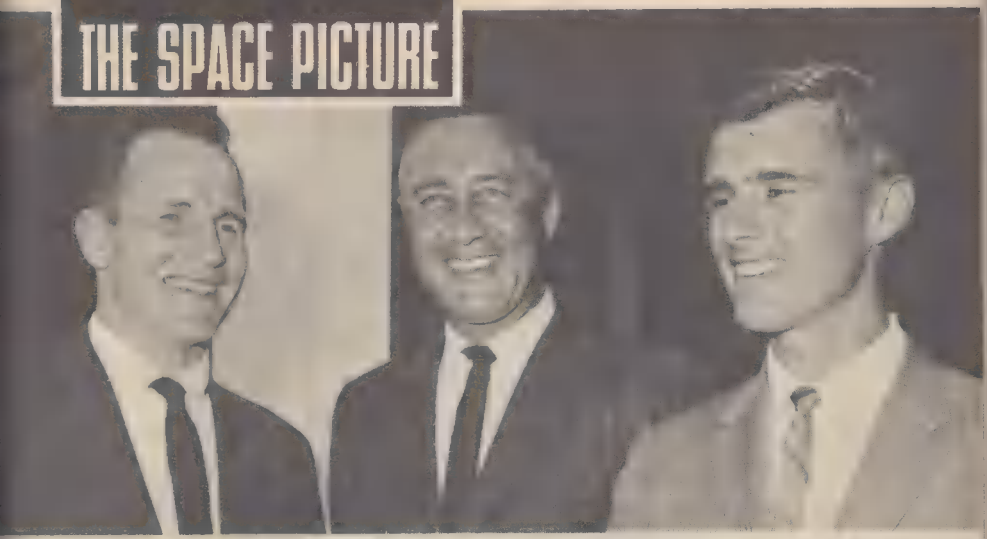
SOURCE OF FLU. A panel of public health experts speculated that the source of some of the great influenza epidemics may be Chinese pigs. Influenza is common to man and many animals including pigs, and the experts feel that the virus may "pop out" of a pig reservoir of the disease in Yunan province.

EMOTIONS AND HEART ATTACKS. For a long time many doctors have suspected that anxious, hard driving men and women are more prone to heart attacks than their easygoing counterparts. Scientists have been trying to figure out why. U. of Oklahoma researchers have found that rats who have their brains electrically stimulated get cholesterol levels three to four times as high as those of normal rats. Cholesterol levels have also been related to heart attacks by many doctors.

SKY MIRROR CONTROVERSY. A way out scheme to light up the jungles in Vietnam by using inflatable, highly reflective satellites has come under attack by astronomers. They are worried because they believe that any device that increases the glow of the night sky interferes with their optical observations.

VIET MALARIA. A leprosy drug is being used successfully in Vietnam to reduce the incidence of a strain of malaria that has proved resistant to standard medication.

QUOTE OF THE MONTH: "It seems clear that the use of psychedelic drugs for hedonistic purposes will remain a problem during the coming years. A careful blending of flexibility, exhoration, education, laws, limitation of supply and rehabilitative efforts should permit us to minimize the numbers of persons involved and retain the overwhelming majority of our young people as productive, active members of society"--Dr. Donald B. Louria, associate professor of medicine Cornell U. Medical College.



THEY GAVE THEIR LIVES. Edward H. White, Virgil (Gus) Grissom, Roger Chaffee, the prime crew for Apollo I were killed in a flash fire during a launch simulation.

A Tribute to Apollo I

Gus Grissom once summed up his thoughts on the dangers of an astronaut's job in these words: "The conquest of space is worth the risk of life."

In the abstract we had all expected that there would be loss of life, but since the space program began astronauts had completed some 1,900 man-hours in space without a single fatal mishap. There had been a few close calls, but in general things had been going so smoothly that all thoughts of danger had been pushed into the background. The tragedy will undoubtedly delay the moon landing. Just how severe the effect will be we do not know as yet. The tragedy will also be a test of the maturity of the American people. The last thing these three brave men would have wanted is to have their deaths used as an excuse to cut back the space flight program in any way. We are sure that they would find renewed vigor and interest in space the most fitting tribute. To that end we present, on the following pages, a preview of Apollo, the great adventure for which Grissom, White and Chaffee gave their lives.

Tense moments from countdown to docking

The countdown begins

Apollo astronauts enter the command module from the service tower alongside Saturn V rocket. At this point a tiny malfunction can stop countdown and delay mission.

Blastoff

The moment when seven and one half million pounds of thrust lift the Saturn V vehicle off its pad, will be seen, via TV, by more people than any event in history.

Separation

Adapter panels swing open and the three-part "heart" of the Apollo mission, the command, service and lunar excursion module, are freed to continue the journey.

Gentle landing

Two of the three astronauts guide the LEM to landing on the moon's surface. Stay on moon will last 4 to 34 hours.

Second blastoff

Using the lower stage of the lunar module as a launch pad, the moon explorers return to third crewman in orbiting mother ship.

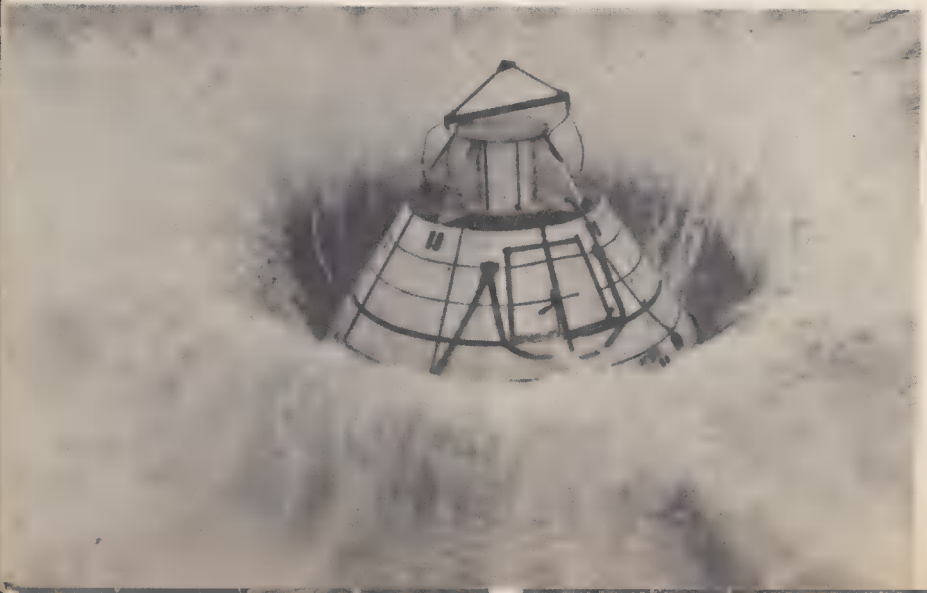
Rendezvous

Astronauts in lunar module line up their craft for docking with command service module which will return them to earth.

The relief of splashdown

Final dangerous step

Back in orbit around earth, the service module is jettisoned (upper left). Command module swings into blunt-end-forward position necessary for re-entry. End is covered by a heat shield that will protect astronauts from 5,000 F. air friction heat. Nearly home now, a parachute is deployed to bring the crew to a safe ocean splashdown. Photo below shows command module undergoing drop test to simulate splashdown.



The revolution is here

by Hubert Pryor

WALTER Orr Roberts summed it up on the fourth night: "The thing for us to realize about the scientific revolution is simply that *it is here.*"

The noted scientist, director of the National Center for Atmospheric Research, was delivering the Joint Address to the 133rd meeting of the American Association for the Advancement of Science.

For the week between Christmas and New Year's, thousands of scientists from the breadth of this land and from 15 others reported on their experiments and studies of the past year, consulted with each other and wondered about the future.

"We are now deep into the age of science," Roberts told them. "It cannot be ignored. Jet airplanes circle the globe in hours. Images of wealth or poverty, or of particular ideology flash into millions of homes everywhere, instantly. Weapons systems can eradicate hundreds of millions of lives in minutes. My voice can be emboossed for my great-grandchildren, yet unborn, on thin mylar and ferrous oxide tape.

"I can strip a tiny fleck of skin from my body and have it preserved, intact, alive and growing indefinitely, in a laboratory test tube, so that a curious inquisitor can examine microscopically the genetic code that makes me most of what I am, even long after I am through being it."

And Roberts went on:

"It is here, this age of science! And with it comes its promise of what the life of man can be, with food for all, with education, with human freedom, with a stable population."

Few at the AAAS meeting could argue with the view that the revolution is here. But most could argue, and did, with any expectation that the revolution automatically bodes perfection for all.

The wary attitude of many of the scientists echoed the meeting's general theme: "How Man Has Changed His Planet."

Scientists almost passionately discussed the shortage of food, the excess of people and the fouling of the world's air and waters. And they got a sharp reminder from Elmer W. Engstrom, chairman of the executive committee of RCA, as he received the William Procter Prize for Scientific Achievement given by the the Scientific Research Society of America.

"There is new urgency today," Engstrom warned, "to the question as to whether our society can maintain effective control of a technology that continues to multiply in speed and power.

"It is necessary for us here to ask

whether we, as scientists and engineers, are prepared to do all we must to prevent our creations from getting entirely out of hand."

The question is no longer a theoretical one, Engstrom said.

"Apparent overconfidence in a technical system recently permitted a catastrophic breakdown to occur in the power supply to a major concentration of the nation's industry and population. Misjudgment of the possible effects of an atomic explosion has disturbed the structure of the Van Allen belts, apparently for many years to come.

"The proliferation of motor vehicles, jet aircraft, and other exhaust-producing machines has contributed to massive pollution of the atmosphere. Uncontrolled disposal of industrial waste and the widespread use of chemical pesticides and weed killers have tainted water supplies and affected marine life."

The consequences, said Engstrom, could be disastrous.

"The introduction of new technology without regard to *all* of the possible effects can amount to setting a time bomb that will explode in the face of society anywhere from a month to a generation in the future.

"Lack of foresight in the past has forced us to create counter-technologies that can alleviate or reverse the harmful effects of earlier technology."

The fault lies, Engstrom implied, in that we know too much.

"This in turn leads to greater specialization and to diminished opportunity or incentive for the individual to gain knowledge outside his immediate field.

"It then becomes more likely that a chemist, for example, might promote in good faith the use of a substance whose harmful effect somewhere in the environment could be anticipated only by a worker in some specialized branch of biology."

What's the answer?

"We could surely benefit," said Engstrom, "from the application to broad areas of technology of the philosophy that we now employ in the conception, design and development of specific systems."

He explained how that works:

"A typical system project begins with examination of a particular need and of alternative proposals for meeting the need. A choice of method follows, and the required talents are enlisted from the various disciplines that can contribute to the end result.

"Each task is pursued and evaluated in the light of its role in the complete system. Moreover, the

E. Engstrom, (r.), gets Wm. Procter Prize.

entire project is constantly under review to take account of actual and prospective changes in the environment in which it is expected to function."

Engstrom said there are stirrings of a trend toward more concerted action. "Yet the total effort today can be considered only a beginning. I believe that more aggressive action is required now to undertake the comprehensive systems approach and action in the broad areas that I have cited.

Cooperation necessary

"I believe, too, that the scientific and engineering community should take the initiative in summoning all of the disciplines and the social sciences to cooperate in determining how technology can be applied to maximum benefit with minimum risk of future harm."

An expert but broad approach is also urgently needed in meeting the social ills of our time, according to another speaker.

To create peace, abolish slums, solve race problems or overcome crime, a pure heart and a little common sense are not enough, said Kenneth E. Boulding, professor of economics at the University of Michigan. He is also an economist in the university's Center for Research on Conflict Resolution.

"If we want to navigate a satellite or produce a new drug or a new hybrid, or even explode a nuclear weapon," he said, "we do not call in old wives.

"Social Sciences' processes of collecting data and testing theory is corrupt."

"In social systems, the old wives, or at least their husbands, are called in all the time."

Boulding blamed the social sciences themselves for part of the problem. He said the existing structure and types of specialization in the social sciences "prevent the development of that general social theory which the nature of the system itself would seem to require."

Boulding mentioned sociology, economics, political science, anthropology and psychology. In those disciplines, he said, present information collection and processing and theory-testing procedure is "not only inadequate, it is corrupt; it is not merely a zero, it is a minus.

"It is an enormous apparatus designed, in fact, to produce misinformation and to prevent feedback from inadequate images of the world, so that the whole organization of the international system becomes organizationally schizophrenic."

In other words, said Boulding, "the existing images of the world are confirmed no matter what happens."

His answer to this "minus" scientific approach paralleled Engstrom's.

A partial solution, which he described as a "kind of fantasy," would involve "a world network of social data station analogous to the

Why Do You Read So Slowly?

A noted publisher in Chicago reports there is a simple technique of rapid reading which should enable you to double your reading speed and yet retain much more. Most people do not realize how much they could increase their pleasure, success and income by reading faster and more accurately.

According to this publisher, anyone, regardless of his present reading skill, can use this simple technique to improve his reading ability to a remarkable degree. Whether reading stories, books, technical matter, it becomes possible to read sentences at a glance and entire pages in seconds with this method.

To acquaint the readers of this publication with the easy-to-follow rules for developing rapid reading skill, the company has printed full details of its interesting self-training method in a new booklet, "How to Read Faster and Retain More" mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Reading, 835 Diversey Parkway, Dept. 690-013, Chicago, Ill. 60614. A postcard will do.

network of weather stations."

These stations would constantly collect data by careful statistical sampling and transmit them to a central agency for processing in the form of maps, indices, distributions and other statistical images.

"It is by no means absurd to suppose, for instance, that all the records of the human race might be codified in a single computer and then search to reveal hitherto unsuspected patterns."

But at the moment, Boulding added, we are not prepared to measure up to the complexity of the social system. "We are using salt spoons to clear away snowdrifts and reading glasses to study the structure of molecules."

A final argument for the systems approach came from William Spring, a graduate student in political science at the University of Wisconsin.

"The same organization genius that catapults man to the moon—the systems approach developed since World War II in defense and space efforts," he said, "can provide vital aid in meeting the equally complex challenges that plague us here on earth."

Spring is a former legislative assistant to Wisconsin's Senator Gaylord Nelson, who heads a Senate subcommittee to see how the Federal Government can help states and localities make use of systems approaches.

The graduate student said the potential has already been demonstrated in California, where four aerospace firms under state contract

have developed imaginative new proposals to deal with crime and delinquency, waste management, transportation, and government information handling."

But the key element in the space effort—the political decision to pay the price required to reach the moon—is missing, said Spring, when we turn to problems such as rebuilding slums, and planning waste management and transportation networks.

"We must instead," he added, "organize for the long haul."

An unprecedented religious twist was given the AAAS proceedings before the meeting adjourned. It came in an all-day symposium sponsored by the Society for the Scientific Study of Religion, the first time the subject had ever gotten into the annual science conclave.

Various speakers reported on difficulties they'd had in efforts to study the influence of religion on people's intelligence and behavior. The culprit in one case seemed to be a stern defense of people's privacy in that area. In another, it seemed to be professional skepticism at a psychologist's inquiry into the nature of religious experience.

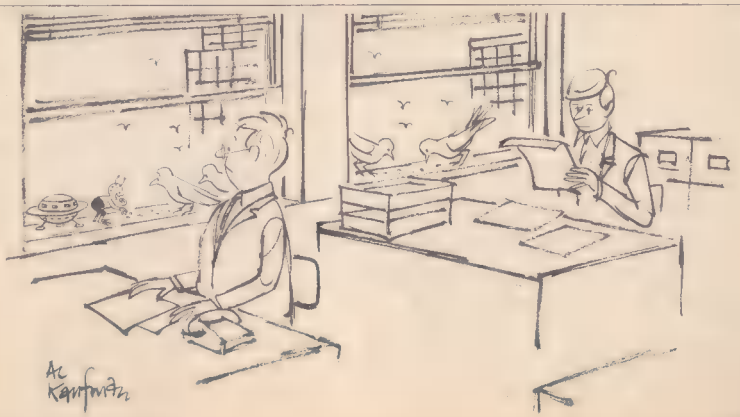
In a third paper, one aspect of religion itself was named as a culprit.

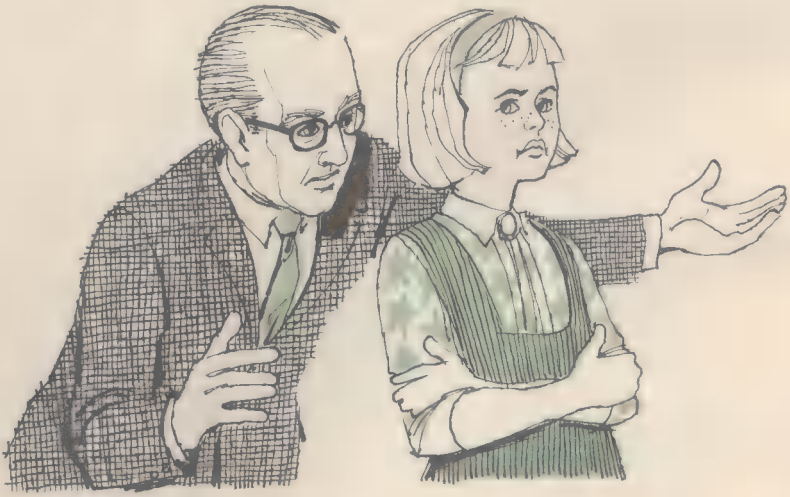
The accusation came from Lynn White, Jr., a professor of medieval history at UCLA. Referring to the meeting's theme, he said technology is despoiling nature because of a way of life stemming from Christian thinking in medieval Europe.

Engineers and scientists may not consciously harbor the idea, he said, but they still reflect the notion of the medieval Christians that "nature has no reason for existence save to serve man."

As an alternative, he proposed the view of St. Francis, who "tried to substitute the idea of the equality of all creatures, including man, for man's limitless rule of creation."

It seemed fairly clear, by meeting's end, that most AAAS members were very strongly on the side of St. Francis.





Help in a crisis

by Flora Rheta Schreiber and Melvin Herman

A LITTLE girl refused to go to school and showed all the classic symptoms of a school phobia. A stubborn case that would have been hard to reverse could have developed except for an alert teacher who promptly took the girl to the social service department of Emory University.

Robert Porter, a social worker was consulted and requested that a parent come in for an interview. When the father came rather than the mother, Porter learned that the wife worked, not the husband. A month previously, the father had suffered a heart attack and now lived in fear of another. He had quit his job and stayed at home farming their small acreage in order to be near home in case of another attack. Porter discovered that the little girl was fully aware of her father's fears which became her fears, too. She frankly told the social worker that she didn't want to go to school because she was afraid that her father might die while she was away from home.

"The father," observed Porter, "had effectively communicated to the child his need for her to remain

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Miss Schreiber is an award-winning writer on psychiatry; Herman, the Executive Secretary of the National Association of Private Psychiatric Hospitals.

at home as a symbol of security and protection for himself. Yet he was quite amazed to learn of the burden which his anxiety about himself had inspired in his child."

The social worker persuaded the father to check his true physical condition with a doctor. Learning that he was not in danger, the father returned to work. Within a week the teacher could report that once the father was on the job, the child was back at school. The father's fear had been the key to the problem. When the delicate balance of family forces was restored, all was well. One year later, the child, freed of her school phobia, had a 100 percent attendance record.

Times of crisis

This story, Porter points out, is an outstanding example of the value of crisis intervention by a trained professional. Some crises occur at times of development or change, like the biological change at puberty, moving from a parent's home, for some at the time of marriage, or at the birth of a child, or facing the death of a loved one, or making an adjustment to old age. These are predictable crises.

Crisis intervention helps also with accidental crises, such as divorce or unemployment. Of course, we aren't in need of constant coddling to help us through our problem periods, but a case like the little girl's shows how easily the real problem can be hidden.

Professional intervention at the time of crisis has a better chance of quick and successful results than help later when the problem is set and hardened. At the moment of crisis the person experiencing it, genuinely looks for a way to resolve the crisis, and is emotionally wide open for help.

Crisis intervention

The case reported here is a striking example of successful crisis intervention. The observant teacher detected the problem early and referred the case immediately. "Judging from the change in both father and child," reports Porter, "one can only conclude that the maladjustive coping system both had been using, had not yet become firmly crystalized." Since both maladies were still in a fluid stage, it was necessary only to disclose to father and child the real focal point of the problem in order to reverse their negative behavior. No treatment was needed. Without crisis intervention at this early stage, both father and child could have become so firmly set in their behavior that the problems could have been resolved only through extensive therapy.

Crisis intervention is not expected to convert everyone who passes through a crisis—and that is literally everyone—into a paragon of emotional and mental health. Crisis intervention theorists do believe, however, that skilled help at the right moment is excellent preventive psychiatry.

Hyperactive tots

Every first grade teacher knows children who can't sit still, who talk too much, fidget, bristle at delay, are irritable, have temper tantrums, fight, tease, are destructive, don't stick with a game or listen to a story to its end; children who lie, are reckless and unpopular with other children. The uncharitable teacher dismisses them as class pests or even potential delinquents; the alert teacher sees them as hyperactive and in need of attention.

Happily, these boys and girls, (boys outnumber girls by five to one) account for only four percent of the school population. They are junior Dr. Jekyls and Mr. Hydes, changing their behavior day to day, at school and at home.

Yet, even when very young, these children show antisocial behavior. In a group of thirty-seven hyperactive children studied by a group at the Washington University School of Medicine in St. Louis, Missouri, sixteen lied persistently and ten stole repeatedly. Only three, however, scored high in three or more classifications in a test to see how thorough their antisocial behavior was.

The majority had shown their hyperactive tendencies before they were four years old. They wore out the family furniture and their toys. Even before they were one, the evidence was clear-cut. Their cribs battered by rough use could not be handed down to another child, but had to be thrown away. As babies, they rocked, jiggled and fidgeted much more than other children.

All the children in this study had normal intelligence and were free from other disorders. There was no evidence that hyperactivity came from injury at birth or was hereditary. Often a chaotic home seemed to be the villian. Still many other hyperactive children, not in the study, are found to have some chronic neurological condition or a brain lesion.

In this study, the hyperactive children were measured against a control group of 47 normal first-grade children. Dramatic proof was given of how common the problem of hyperactivity is, where three children out of the normal group turned out to be hyperactive.

The study showed that the signs change day by day but that physicians can diagnose the condition and begin to help with the problem long before the child goes to school.

The important question is what will happen to them later. Will they grow up to be sociopaths if their courses are not changed as early in life as possible?

Looking at yourself

Can taking a good look at oneself turn out to be therapy? Socrates said, Know Thyself. But Floyd S. Cornelison, M.D., in experiments at Friends Hospital in Philadelphia, is satisfied with testing whether just a look at oneself in action will help. He takes movies of patients and

these show the patient to himself.

One day, for instance, one of Dr. Cornelison's patients, an alcoholic, was bewildered when the doctor offered him a drink and then another and still another. The patient swallowed the first in disbelief and then settled down to getting drunk.

After a night's rest, when he was sober, the treatment began. He was shown a motion picture of himself in a drunken state. The patient's response was one of startled incredulity. In taking a good look at his behavior in the film, he saw himself drunk for the first time.

"None of us has really seen himself," says Dr. Cornelison. "Our self-image is not very realistic. When we do see ourselves, we are invariably surprised. Sometimes this confrontation, especially for alcoholics, who have never seen themselves drunk, is upsetting. To many it is enlightening."

Self-image acts as tool

The self-image, as Dr. Cornelison uses it in therapy, becomes a constructive tool, he believes. His aim is to get people from actual observation of themselves to think about how they appear to others. This confrontation with oneself is used to help the patient to accept reality and to achieve emotional stability. Often an immediate change of behavior occurs after the patient sees the movie.

Dr. Cornelison sees this approach as useful with patients who have not responded to other forms of treatment. The method seems to be particularly adaptable to alcoholics. Dr. Cornelison has only worked with a few but he was able to report in a paper published in *Mental Hygiene* that each has improved, some to the point of being able to return to steady jobs.

When everyone helps

The therapeutic community is a concept that is being widely endorsed in psychiatric hospitals.

Let's take Mrs. Jones, the patient. Everything in her day is planned to be therapeutic. She sleeps in a room that is as close to being a home bedroom as possible, her mealtime is a pleasant hour of social contact, the rooms in which she spends her day are comfortable and inviting. She has a hand in planning her social activities and for this purpose serves on a patient committee just as she would at home serve on a community committee. In fact, quite a number of community meetings are held to decide many different problems that face the hospital community. She probably has work to do and a hand in deciding about it. Decision-making is handled in a very large part by the committee of patients or of patients and hospital staff members combined.

The traditional hospital hierarchy is deemphasized. All this committee work is a constant challenge to the skills of the hospital staff. It takes a good staff to make the therapeutic community work.

Why Can't You Control Your Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear, or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new book, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 835 Diversey Parkway, Dept. 690-013, Chicago, Ill. 60614. A postcard will do.

The theory is based on the premise that everyone's environment is either helpful or harmful and that emotional growth can be achieved when all the factors are coordinated to the maximum therapeutic benefit. This includes all relationships.

The customary psychiatric therapy is not usually discarded. Individual psychotherapy or any other useful technique is employed but the main reliance is apt to be the group—group sessions, group meetings. Everyone in the hospital community is part of the patient's therapy and influential in his recovery.

The therapeutic community has not been rigidly defined. It has taken on many forms in different hospitals but there is a family resemblance. The treatment of the individual is not neglected but his social adjustment within the hospital is emphasized. The patient finds many opportunities for testing and experimenting with his ability to develop behavior that is appropriate to his immediate social environment of the hospital and acceptable to the general community.

Industry also is showing a considerable interest in the therapeutic community concept, for the basic principle on which it rests, striving for healthy social and work interaction in all our communities and to some extent its method of operation, seeing that the groups we function in are democratic and sound, are applicable to the "well" community as much as to the hospital community.

INVENTOR OF THE MONTH

Big wheel in gears

Ernest Wildhaber, holder of 300 patents, exhibits components of gear coupling.

ERNEST Wildhaber, who recently was granted his 300th U.S. patent, is an important cog in the gear world. One of his early inventions, the hypoid gear (1925), transmits power from the engine to the rear wheels of every American passenger car.

The 300th patent (3,292,390) covers a gear coupling that is being developed by the Sier-Bath Company, Inc., North Bergen, N.J. A toothed rod, or hub, fits into a hollow sleeve to transfer motion, over varying angles, at the joint in a shaft.

Over the last 42 years, the *Science Digest* Inventor of the Month has averaged one American patent every seven weeks, and has obtained several hundred abroad..

His inventions include the Curvic clutch, described as having made the turbo-prop engine practical, and a tool called Revacycle for making differential gears.

Dr. Wildhaber (the Technische Hochschule at Zurich, from which he received an engineering degree in 1916, recently made him an honorary doctor of engineering) has received several awards from the American Gear Manufacturers Association. In 1964 the Franklin Institute, Philadelphia, presented him its Longstreth medal.

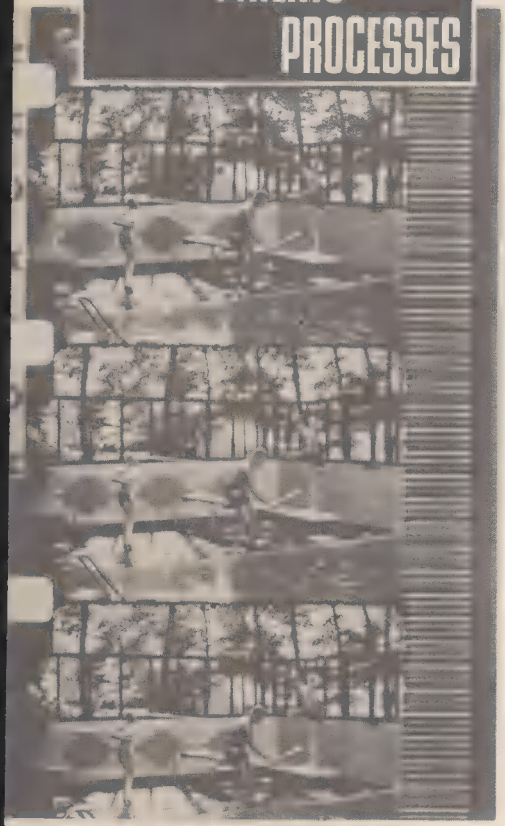
Representative Frank Horton of Rochester, N.Y., wrote President Johnson that the Swiss-born inventor "must be considered one of the chief contributors to this nation's motorized society."

For a quarter century, Ernest Wildhaber was a research and development engineer for the Gleason Works, Rochester, and at 74 is still ■ consultant. The company makes gears and gear-cutting machinery.

Last March the Sier-Bath Company introduced the coupling to the trade at a luncheon in the Engineers Club, New York. Marlene Schmidt, the 1965 Miss International Engineer and a former Miss Universe, was brought over from West Germany to serve as hostess.

—Stacy V. Jones

INVENTIONS
PATENTS
PROCESSES



Talking home movies

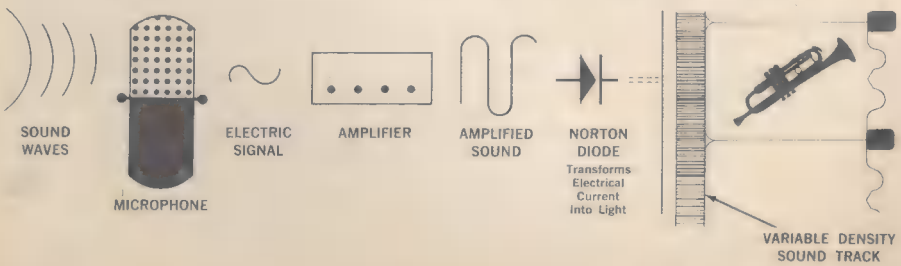
HOMEMADE "talkie" movies are now feasible with a beam of light that "writes" sound on the film as the pictures are being taken.

The Norton Company has developed what it claims is the first practical method for producing silicon carbide diodes with light-emitting characteristics. The process operates on the principle of converting electrical energy directly into a needle-thin beam of light.

A microphone picks up and transmits the sound to an amplifier. Pulses of electrical current pass into the Norton electroluminescent diode from the amplifier where they are transformed into flashes of light which move directly onto the film, thus producing the integrated sound track.

The stickiest problem the Norton

Variable density sound track (to right of film frames above) adds dimension of sound to standard home movie. Schematic diagram, below, shows how sound is converted into electric impulses and transformed into flashes of light that "write" the sound track.



technique had to overcome was achieving the high state of purity in silicon carbide essential to building light-producing diodes. Purity is important because the color and intensity of the light are determined by the amount and type of impurities added.

The new diode requires no lenses or optics, is smaller than a match head and takes only 10 percent of the space of conventional equipment. A frequency of up to 6000 cycles per second is obtainable.

The silicon diodes can also be used to record data on film, scan images on film and form components in advanced computers.

Versatile satellite

A VHF communications system for commercial aircraft is being tested from a satellite orbiting over the Pacific Ocean.

The 1,542-pound Applications Technology Satellite (ATS-B), one of the heaviest spacecrafts ever in synchronous orbit is the first of five satellites to monitor air traffic. Hovering over the Christmas Islands South of Hawaii, it will be able to "see" an aircraft almost anywhere in the Pacific.

Two-way voice signals will be virtually immune to the radio interference that for years has plagued Pacific aircraft communications, according to Clare G. Carlson, manager of the Hughes Space Systems division, builders of the satellite for NASA.

A phased array (electronically despun) antenna boosts signal strength of the satellite. It has 16 elements phased so that a concentrated pencil beam is generated and aimed at earth.

An antenna like this may someday be used on large educational TV satellites that would have signals so strong that schools with six-foot antennas could receive programs from it, Carlson contends.

A global system of VHF satellites to plot aircraft location and control traffic from one central station may be another outcome of a successful series of tests.

Ships could also communicate through the satellites.

Another experiment of the ATS-B is microwave transmission of weather data and weather maps, television voice, telegraphy and digital data.

Radar-reflecting flare

A rocket-launched chaff flare that may treble the chances of success of sea-air rescue has been developed by National Engineering Science Company.

The radar-reflecting chaff flare can pinpoint the exact location of airplanes and ships floundering in distress.

The flare, eight inches long and weighing 20 ounces, consists of a watertight tube containing a launcher and a rocket with the radar-reflecting chaff package.

When triggered by the hand-held launcher, the rocket reaches an altitude of 2,000 feet in four seconds and ejects the metallized chaff,

creating a cloud that can easily be seen on a radar scope. Because it can provide a radar target at this altitude, land or sea background clutter is eliminated.

The chaff cloud descends at a rate of 40 feet a minute, allowing radar visibility for half an hour, according to NESCO engineers.

An optical flare that is ejected with the chaff and burns for 30 seconds is optional.

Aside from military and commercial use, civilian boaters will find it handy in emergencies. It can also be used to recover "free running" oceanographic instrumentation packages, retrieve buoys and locate sunken submarines.

New heat generator

A new technique for production of two heat-producing radioisotopes has been developed by Sanders Nuclear Corp.

Thulium-170 and Thulium-171 are abundant heat sources for the generation of electrical and mechanical power. The Sanders process is economical, provides safety from radiation and can produce isotopes in sufficient quantities to have immediate and varied uses. They can be used to power cardiac pacemakers and to heat diving suits worn by divers in frigid waters, at depths up to 600 feet.

The company predicts that knowledge culled from the Thulium experiments will contribute greatly to the nation's space program in the field of isotopic systems.

Robot with muscles

Man in all of his ingenious inventions, has never been able to assemble a machine that simulates his own muscle power. Now, at the Weizmann Institute of Science in Israel, a family of robots that converts energy in the same way that human muscles do has been developed for the first time.

According to a report in the *Saturday Review,* one of the robots is able to raise and lower levers; another is able to turn a crankshaft with a piston drive.

The "robot with muscles" duplicates the human chemical conversion system with contractions of synthetic fibers made of artificial collagen.

Human muscle contraction is produced by a single solution of salts—blood. The blood carries in it a chemical, adenosine-5-triphosphate (ATP), which is a concentrated bundle of pure energy. Polymers, strings of macro-molecules that act as a single unit, form muscle fibers that contract as a response to chemical metabolism within the fibers.

In 1947 Professor Aharon Katchalsky discovered that there are electric charges attached to the macro-molecules that form the polymers, and that it is the interaction between the negative-positive charges of the salt solution and the polymers that causes the muscle contraction.

Prof. Katchalsky, now head of the Department of Polymer Re-

search of the Weizmann Institute, developed the method of imitating the function of the blood by utilizing two fluids—a concentrated salt bath and a dilute water bath. The synthetic fiber, cut in rubber-like bands, pulses automatically when passed alternatively through the two solutions. The professor emphasizes that the energy source for robot muscle power lies in the concentration of the salt solution, not in the salt itself.

Aside from illuminating some aspects of muscle action in the human body, this muscular energy principle may ultimately be applied to help solve the problem of water desalination.

High "Q" quartz

An improved method of quartz crystal growing can produce a synthetic material that may replace natural quartz in all communication devices.

Developed by Bell Telephone Laboratories, the new man-made quartz attains the critical properties of stable, precise frequencies found in natural quartz.

Until now, modern electronic communications—telephone systems, data networks, satellites—has depended on natural quartz crystals for these qualities.

Quartz for electronics systems has been artificially grown since 1945, but the method resulted in a grade of quartz with a low "Q" which could be used only in filters, low-frequency oscillators and other, less exacting communications equipment.

Q is the measure of the efficiency with which a crystal converts mechanical energy into electrical energy and vice versa. The higher the Q, the greater the stability of the crystal's resonance and the higher the frequency at which it is useful.

The key to the process is lithium nitrite. Researchers found that by adding this compound to the sodium hydroxide solution used in the usual hydrothermal crystal-growing process, they could increase the Q of the synthetic to one million. The Q could also be increased to two million—the equivalent of natural quartz under optimum conditions.

Chemists who developed new crystal-growing technique examine sample of the quartz.

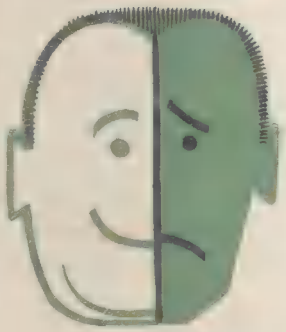
THE PROGRESS OF MEDICINE

Butterballs, stay fat

by Arthur J. Snider

Some butterballs are better off remaining fat and happy than becoming slim and miserable, a Northwestern University physician says. Food restricting regimens can create great emotional trauma in some super-obese, he cautions.

It is not the need to eat that drives such persons as much as the need to be fat, Dr. Howard D. Kurland contends.



Obesity is unconsciously sought because: (1) It's pleasant to be regarded as a fat, jolly man. People are generally kinder to you. (2) People equate bulk with rosy good health. (3) Sheer size often enables one to dominate smaller people. (4) Not as much physical work is expected of you.

As an illustration of how obesity is needed for emotional equilibrium, the physicist cites the case of a 20-year-old Navy corpsman who lost 50 pounds to meet enlistment requirements.

"Shortly after discharge from the hospital, he was confronted with routine expectations that he prepare himself for advancement in rank," Dr. Kurland says. "He was expected to perform certain physical tasks from which he had been previously excused. In his more slim and physically-fit shape, his wife expected him to be more active.

"He was able to endure these psychological hardships for little more than a week. Subsequently, he overate massively and gained a pound a day over the next two months. Eventually he regained his weight and his psychological equilibrium."

While conceding that physicians usually order fat persons to lose weight, Dr. Kurland suggests that some have more to lose than flab.

Operation unneeded

A routine chest X ray disclosed the suspicious mass. Signs pointed to a lung cancer in the 53-year-old

male, a long-time cigarette smoker. Yet a positive diagnosis could not be made.

Usually under such circumstances doctors follow one of two courses: They wait and watch, calling the patient back for frequent examinations. Or they perform an exploratory chest operation, a major procedure involving a certain degree of risk.

A third alternative—a remote control biopsy—is offered at the University of Chicago Hospital. Under local anesthesia, a thin hollow tube is inserted into the nose and down into the windpipe. Guided by a fluoroscope, it is threaded to the suspect lesion. Then a bristled brush is inserted in the hollow tube to swab off some cells for laboratory analysis.

It is also possible to insert a pair of snippers through the tube to clip a bit of the tissue for a more detailed examination.

In the case of the 53-year-old patient, the technique showed the mass was an infection and not a cancer. It relieved his anxiety and made an exploratory operation unnecessary.

Dr. John J. Fennessy tells of 100 patients with suspicious lung masses on which a cancer could not be confirmed by X-ray studies or other conventional methods. He reports that 48 cases proved by remote biopsy to be cancers. The other 52 were benign tumors, abscesses, bronchial disturbances and other inflammatory conditions.

Dr. Fennessy's method is essentially the same as bronchoscopy, which permits examination of the large bronchial tubes through an instrument. But the bronchoscope is not capable of visualizing the branches of the major air channels in the lobes of the lung beyond the reach of the instrument. It is here that most lung cancers occur.

An added benefit may accrue to the technique. In lung infections that refuse to clear up, drugs can be instilled directly into the infection by introducing them through the catheter rather than administration by way of the blood stream.

Paraplegic cure?

One day a surgeon may snip a bit of brain tissue from a paraplegic, insert it in the severed gap of his spinal column and perhaps enable him to walk again.

It is only a distant prospect at the moment, but Dr. Leslie W. Freeman, director of the surgical research laboratories, Indiana University medical school, is encouraged by what he has seen so far in paraplegic animals. Some are beginning to walk.

Should the still-remote hope be realized in human beings, it would create a huge medical boon.

The paraplegic problem came home to Americans during World War II. Thousands of GI's were paralyzed in the lower limbs and many in the upper limbs as well because the electrical cables of the spinal column were cut by wound or injury.

Viet Nam casualties are adding to the burden but these numbers do not begin to compare with the toll being mounted by peacetime accidents on the highways, in swimming pools and athletic fields.

Even though a solution for spinal cord injuries has not been a popular field for research, Freeman and his neurological associates have been working on it since World War II.

A dozen ideas have been tried to find a way of getting around the scar tissue blockage that prevents the electrical nerve connections from being reestablished.

It is possible to remove the scar and leave a vaccuum, but the axons —the long, thread-like outgrowth of nerve cells—won't pass through it.

Substitute materials, such as gelfoam, have been tried, but they eventually degenerate. Even a cigarette-filter-like material was tried. Axons would grow into it for a time, but eventually connective tissue infiltrated and choked them off.

Basis for the current encouragement is research by two of Freeman's resident physicians, Dr. Chun Ching Kao of Taiwan and Dr. Shimu Yoshifuss of Japan.

Freeman conceived of using natural brain tissue from the animal itself as the spinal cord bridge. Snipping a pellet about the size of a peanut would leave no brain deficit. This has been demonstrated by the removal of brain tissue in tumor surgery.

First reports were disappointing. The brain cells disappeared and left scar tissue in their place.

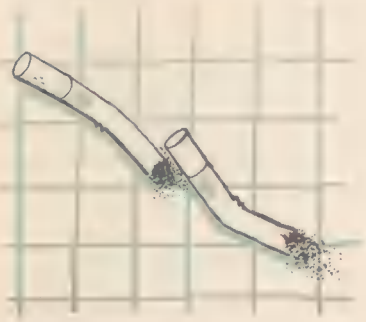
Then Kao adopted the technique of first growing the brain cells in tissue culture, then transplanting them. Cultured transplants live only a bit longer than the uncultured but they leave a residue that blocks the growth of scar tissue without impeding the growth of nerve fibres. Dr. Kao won a residency training program award from the American Academy of Neurological Surgery for this contribution to a cure for paraplegics.

After several months of observation, the nerves are still growing in animals. One animal has achieved complete recovery and others are in various stages of mobility. Freeman suspects there might be a factor in the brain cells that promotes growth. But he declines to speculate on the long-term outlook. For one thing, wounds in animals are not the same type as those incurred in patients. Secondly, animals are treated immediately after trauma while human patients usually do not come under therapy until after scar tissue is formed. Surgeons usually wait to see if enough spinal nerve connections remain after damage to the spine for the patient to recover spontaneously.

Thus the first patients are likely to be long-time paraplegics with old scar tissue. Freeman demonstrated several years ago that the nerve-growth function in most of these individuals continues. Having no place to go when hitting the barrier, the axons tend to curl up in a ball.

Fewer smokers

The latest report from the American Cancer Society's continuing study of cigarette smoking habits shows a sharp decline for the half-million men and women in the group.



Among men, 45.8 percent were cigarette smokers in 1959 but only 35.8 percent smoked in 1965. For women, there were 25.8 percent smoking in 1959 and 22.6 percent in 1965.

"With the passage of time," the report said, "a certain proportion of adult smokers give up the habit because of ill health. A larger proporation give it up or reduce their consumption apparently for other reasons. Presumably, reports linking cigarette smoking to increased death rates from lung cancer, emphysema, heart disease and other diseases had a major influence."

LSD for the dying

Patients dying of cancer were given the hallucination-provoking drug LSD to see if they could relate better to their environment and communicate with their families in the last months or weeks of their lives.

The drug was injected with full knowledge and consent to 80 patients by Dr. Eric C. Kast of the Chicago Medical School. He found it caused them to "view events in and around them with greater clarity and with three dimensions. Through this insight, communication was greatly facilitated. It eliminated their depressed state for as long as two weeks. Some had discovered a depth of feeling and perception they had not thought themselves capable of."

Although the experience was short-lived and transient, it was a welcome change in their monotonous and isolated lives, Dr. Kast said.

Retina is spun back

By whirling a patient around in a centrifuge, it is possible to force his detached eye retina back into place and restore central vision.

This has been accomplished at the Mayo clinic. An 18-year-old male patient was subjected to a force between two and 2.7 g (gravitation) for 135 minutes in five interrupted sessions.

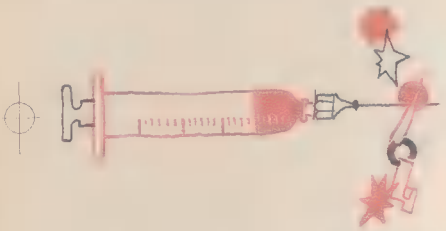
The retina was partially restored to place and then anchored by diathermy. The patient left the hospital with good vision.

Among the advantages of this treatment, explained Dr. R. W. Neault, is that it can be carried out

in a short time. It may replace therapy which keeps the patient recumbent and motionless for long periods in an effort to persuade the retina into proper position.

Colds: new hope

Prospects for a universal common cold vaccine are brighter, a Tulane University specialist says, because of the belief that only a limited number of viruses cause most of the colds. It has been thought that the number of viruses would be so large as to preclude incorporating all in a single vaccine.



Dr. William J. Mogabgab says a study of common colds involving more than 1,000 students reveals only seven virus strains to be responsible for more than three-fourths of the colds contracted over a four-year period.

Dr. Mogabgab, professor of medicine, is currently investigating vaccines against three of the viruses found in the study. The tests are being carried on at Keesler Air Force Base in Mississippi.

Only 10 different types of cold virus were found in 1,230 Tulane students with upper respiratory illnesses. Of these, seven were found to be the most important.

In a companion five-year study at Keesler Air Force base, Dr. Mogabgab found seven viruses caused more than 50 percent of the colds. Six of them were of the same type that caused colds in the students.

The reason for the limited number, Dr. Mogabgab believes, is the cross-protection afforded by the viruses. They induce antibody formation not only against themselves but against other cold viruses.

Dead wrong

Physicians too often are attributing cause of death to a "clinical impression" and thereby are diluting the value of death certificates for public health, contends Dr. Ellis D. Sox of San Francisco.

He reviewed the cause of death ascribed by physicians for 43,000 persons between the ages of 15 and 74. Autopsy records were available in 62 percent. For the rest, medical histories, personal interviews and other sources were consulted.

He found that heart disease was cited six percent more frequently than was justified. Alcoholism was found to be the underlying death cause in 129 percent more cases than reported.

Suicide, syphilis, diabetes, allergic, endocrine or metabolic disorders were misclassified to various extents. By contrast, deaths due to cancer were under-recorded by more than 5 percent.

THE ASTRONOMY STORY

A 'robot' on the moon

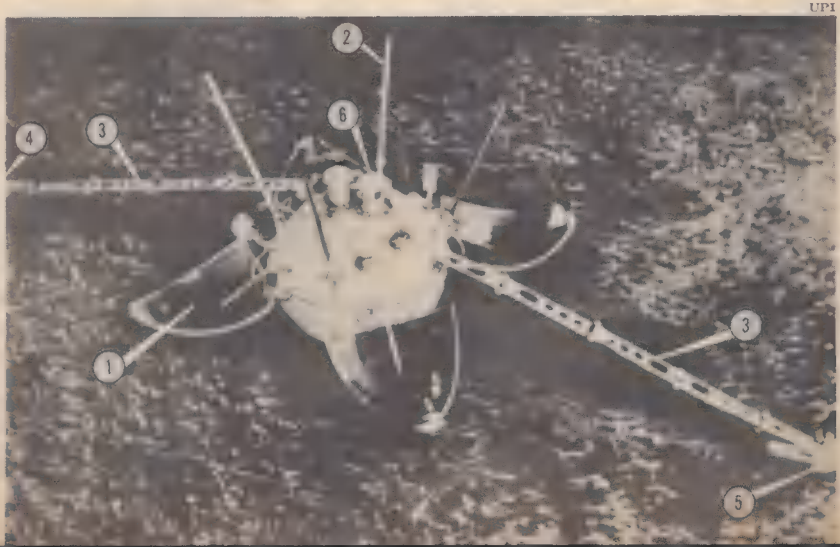
THE sphere-shaped Soviet research instrument dropped to a jarring but not shattering landing on the moon's surface. Slowly the three petal-like antenna's unfolded, forming stabilizing "feet" under the sphere. Automatically two slender booms extended from the center of the instrument for a distance of about five feet until they gently touched the lunar surface. Then came a small but violent explosion as a gunpowder-powered jet device drove a rod nearly 12 inches into the moon's soil.

This is roughly the sequence of events that took place when Luna 13, the Soviet Union's second automatic research station was soft-landed on moon at the end of last year. Diagrams showed the instrument to be an almost exact duplicate of Luna 9 which hit the moon Feb. 3, 1966. Major additions to the earlier instrument were the two slender booms which contained the devices for measuring the moon's surface density and firmness. The rod fired into the moon was one of these tests of surface firmness.

A dynamograph was another instrument aboard the station. Its task was to record the duration and force of the impact impulse, reflecting the degree of hardness of the moon's surface.

All the instruments indicated that the surface properties of the moon,

Artist's rendering of Luna 13, the Soviet Union's second automatic research instrument to be soft-landed on the moon's surface. According to Izvestia, the Government newspaper, the drawing shows: (1) Petal antenna; (2) a pintle, or revolving antenna; (3) five foot extendable booms that holds to surface (4) a device for measuring surface density and (5) a radiation density meter. The craft's television camera is identified as (6). UPI



at least to a depth of 12 inches, are very similar to those of medium density earth soil.

Luna 13's radiation meter indicated that the radioactivity level of the moon's surface was low. Television cameras sent back detailed photos of the surface taken from a height of about five feet. They showed a rough surface strewn with stones of varying sizes. Soviet scientists have been unable to decide whether the stones come from volcanic eruptions or from the smashing of meteorites on the surface.

Western observers were intrigued and a bit puzzled by the tone of the Soviet announcement on the findings of Luna 13, for it laid great stress on the value of unmanned automatic research stations, but said nothing about manned flight.

"There is no doubt now," the Russian Press release said, "that it is these cosmic stations that can supply the information permitting a new approach to solve such important problems of science as the origin of the solar system, the origin and development of life on other planets and the internal structure of celestial bodies."

It has been generally assumed that the Russians were planning a manned moon shot, similar to the U.S. Apollo mission (see page 9), but since secrecy always surrounds the entire Soviet space program, they have never been publically and officially committed to such a goal, and in the past there have been hints that the manned program has been abandoned.

Lunar controversy

THE "daily almost hourly" flow of new information from U.S. and Soviet moon vehicles has by no means settled the many controversies surrounding that body. On the contrary, it seems to have opened entirely new areas to scientific debate. For example:

Dr. Eugene Shoemaker of the U.S. Geological Survey believes photos show that many of the moon's features were created by impact with meteorites.

On the other hand Dr. Jack Green, a geologist and geochemist said, "Over 95 percent of the major lunar surface features appear to be volcanic."

One of the Soviet Union's leading biochemists attacked the commonly held idea that no forms of life will be found on the moon. Alexander Oparin recently wrote, "I think organic substances are quite possible on the moon."

Harvard astronomer Donald H. Menzel questioned the concept of a waterless moon. "I think it is very possible that some of the lunar rocks contain water of crystallization. If this is so, there is a real possibility for man to establish self-supporting expeditions on the moon."

How and when will all these controversies be resolved? The 66 year old Menzel said he hoped NASA would waive age limitations for astronauts so that he could go to the moon and answer some of the questions himself.

THE COLLEGE SCENE

Science vs adventure

"An adventure," according to the late explorer-scientist Dr. Roy Chapman Andrews, "is a result of bad planning." Yet few scientists led a more adventurous life than Dr. Andrews, whose discovery of the first dinosaur eggs made him and the Gobi desert famous. The apparent contradiction? Semantics. Andrews referred to "dilemmas;" not to the adventurous pioneering inherent in science—both in lab and in field.

How much adventure do you want? Take a look at some current field projects from campuses across the land:

Prof. *Charles R. Bentley* of the **U. of Wisconsin** Geophysical and Polar Research Center can look back on a decade of exploration in the coldest hostile environment on earth—Antarctica. Since his first trip "south" in 1955-56, paving the way for IGY studies under National Science Foundation grants, Bentley has seen 68 **Wisconsin** colleagues blaze ice cap trails each polar summer (October to March). Most have had a far easier time than he did on that first trip. There was no air shuttle from New Zealand in '55. The men went down on ice-breakers, rolling 100° across the sky through the roaring forties, smashing through pack ice for days on end. Until buildings were erected, they lived in tents on the ice, while blizzards howled with winds over 100 mph. Wearing crampons and fur-ruffed hoods, carrying ice axes, and often hauling their own gear on sleds, they struggled up heavily crevassed glaciers to the 10,000-foot-high polar plateau. There, under incredible conditions in which fingers froze to instrument knobs on contact and frostbite was standard, they paved the way for the ten years of ice cap research that painted a brand new picture of the last great white area on the world's map. Startling facts they discovered:

- The entire Antarctic continent has been pressed down an average 2000 feet by the weight of ice.

• The gigantic ice cap (6,000,000 square miles) is three miles thick in places.
• Mile-high mountains are buried in some parts of this cap.
• Even with all ice removed and consequent uplift of land, much of West Antarctica still would remain below sea level.
• Earth's crust thickens from 19 miles under West Antarctica to 25 miles on the Eastern side.
• The Antarctic ice cap probably is not decreasing; it may be growing.

"We're nearing completion of our reconnaissance of Antarctica," says Bentley, "and have started the next phase—detailed examination in areas of interest."

Off on a three-year project that will take them sailing in and out among the Galapagos Islands in an open fishing boat, 600 miles off the Ecuador Coast, *Dr. Paul A. Colinvaux,* zoologist at **Ohio State U.,** and four graduate students, have added a new chapter to their diaries.

Searching for a climatic record of the islands, the group—sun-browned and salt-licked—beached their boat in surf, trudged deep into barren interiors to take cores from lake bottoms, bringing up sediments laid down 18-20,000 years ago. From the sediments, they'll extract fossilized plant pollen and fragments of animals that will give them a picture of changing vegetation through the years—a key to weather cycles.

Best core came from a crater lake known as El Junco on San Cristobal, yielding a sediment column 15.35 meters long—15,000 years' worth.

Just getting to inaccessible mountain lakes provided the party with hazards enough. Carrying all their gear, they had to clamber up the sides of a near vertical lava cone, then slide down the inner wall to reach the lake (see page 39 for details of this exploit).

Other members of the group included *David Greegor,* **Ohio State**; *William Horn,* **Duke**; *Curtis Mc-*

Ginnis and *Erno Bonebakker*, **Yale.**

Quasar Quandry

Originally thought to be gigantic exploding galaxies near the edge of space, those curious quasars throw scientists into quandries all the time.

Now, two **U. of Michigan** scientists, *Hugh D. Aller* and *Fred T. Haddock* have detected rapid changes in a specific characteristic of polarized radio signals from a quasar. "This rate of change is so rapid that the region producing it must have a diameter less than one tenth the distance from the sun to the nearest star," they report.

This means quasars may not be nearly so big or so far out as had been thought. Our own Milky Way is 25,000 times larger than the quasar studied by Aller and Haddock, according to their new calculations.

But here's the problem: the power radiated by the quasar is many times that radiated by the entire Milky Way Galaxy. Why? No one knows.

Terrible truth about wisteria

A **Cornell U.** botanist in the **N.Y. State College of Agriculture,** *Prof. John M. Kingsbury,* has determined that plants rank sixth in causes of poisoning in children under five.

Prof. Kingsbury says that pesticides often are blamed in cases of plant poisoning, when the real culprit may be the plant itself. More than 700 species have been recognized as poisonous in the United States, including many common garden plants. Wisteria, one of the most potent, was first shown to be toxic in 1961. Now the American beech is under suspicion. Other known deadly varieties: wild cherry, laurel, rhododendrons, yews, mayapple, buttercups, star-of-Bethlehem, water hemlock, wild iris root, black locust, oaks, bracken.

Sherlocking buffalo bones

When two amateur archaeologists unearthed a pile of old buffalo bones near Kit Carson, Colorado, they alerted experts at the **U. of Colorado.** *Prof. Joe Ben Wheat,* curator of anthropology for the school's museum, took over. For two years he directed digging on the site. The bones were grouped in piles, each pile containing different types of bones. Here are just a few things Wheat was able to deduce from the find:

The hunt took place 8,500 years ago—in May or June, judging from the age of the calves.

The animals had been butchered a few at a time, evidenced by the grouping.

The wind was blowing from the south. Buffaloes have a keen sense of smell, but poor eyesight; the Indians would have had to approach them from down wind; from carcass positions the animals were facing south in an arroyo.

The hunters were members of a tribe of about 150 indians (based on the amount of meat each animal

yielded; the amount one indian could eat per day and how long dried meat could last; plus the time it would take to butcher a buffalo, and the weight of meat each member could carry).

Fascinating Items From the Quadrangles

Bumper-to-Bumper animals

Forest trails are jammed with traffic. That's the word from wildlife specialists *Lloyd Keith* and *E. C. Meslow* of the **U. of Wisconsin,** who ran a count on hare runs in Alberta, Canada. In a four month period, 11 species of mammals and seven bird species used the runs on a regular basis. In winter, lynx, coyote and foxes ran up the total.

The project will provide game specialists with data on contact between animal types, and will yield clues to the influence of stress, predation and disease on natural balance of species.

20th century bug net

A new experimental teaching aid, known as a "Micro Bio Gun" is being evaluated at the **U. of Maryland** for the National Science Teaching Association's Materials Review Committee. Demonstrated in the photo (left) by coed *Pam Randolph,* the battery-powered device pulls bugs into a trap chamber like a vacuum cleaner.

There's an Orthotetrakaidecahedron in your future

The 14-sided figure named above, is the shape of the future for everything from houses to space ships, according to its inventor, *Prof. Donald Wood,* industrial designer of **Ohio State U.**

Wood explains that the shape is a "stack and pack" unit that is a happy medium between a sphere (which has the best surface-to-volume ratio) and the cube (having one of the worst).

Your home is a sea of smog

Dr. Igho Kornblueh, M.D., of the **U. of Pennsylvania,** announces the startling fact that air inside an average home is more polluted than outside air, and that the contaminants are more sinister. Chlorine in water escapes with cooking steam, along with fats and oils. Smoke, carbon monoxide run high.

"While only mildly irritating," says the doctor, "there is no proof that exposure over the years is harmless."

Hundreds of unique land iguanas, some of them about three feet long, appear almost invisible against the rugged terrain on Fernandina Mountain in the Galapagos Islands.

I see where they...

From the Editor's desk

. . . have found a dead volcano full of lizards.

The volcano is Fernandina, a 50,000 foot high mound of lava standing like an upturned bowl on gradual slopes. It is one of the Galapagos Islands. Inside it there is a crater five miles wide and some 2,000 feet deep. A third of the crater floor is covered by a lake.

When a four-man expedition from Ohio State University climbed the crater and descended its inner walls they found a different world. From the water Fernandina looks entirely barren, a cone of streaky rocks haloed by clouds or shimmering in a haze of heat. But inside, the crater is richly vegetated and abounds with animals. Most unique are the large land iguanas (like those shown above). The scientists reported a healthy, teaming population of these otter-sized reptiles. The also reported numbers of Galapagos ducks, mocking birds, finches and doves. Endemic Galapagos rats also abound.

. . . are worried about new species of birds.

The Air Force Office of Scientific Research says that dangerous bird-aircraft collisions are far more common than the public suspects or than pilots care to admit. They note that the most troublesome bird is the starling, which is also an agricultural pest and a general nuisance.

But the starling is not a native American bird. It comes from Europe where it is not considered a pest. It was brought to the U.S. in 1890 by a wellmeaning bird lover who wanted to see in Central Park all the birds mentioned in Shakespeare. Because of lack of natural enemies it is now one of the com-

monest birds in the country.

Scientists note that many species seem to exist at a low density for years until they reach a critical density or adaptation that enables them to launch a population explosion. They note that the mynah bird, introduced into Vancouver Island in the 1920's now has a breeding density of several hundred pairs. Is it a possible threat? There are three species of parrot living wild within the city limits of Los Angeles. In some parts of the world parrots are a major pest of corn grains. Finches are an unbelievable pest in Africa, yet one pest finch, the Red-billed Dioch, is widely stocked in pet stores today.

. . . have discovered that people believe their eyes more than they should.

Bell Labs psychologists Charles and Judith Harris found that even when a subject's vision was seriously distorted by special glasses they still continued to believe their eyes. After wearing the glasses for just a few minutes, college students were mistaken about where their own hands were and what they were doing—even to the extent of writing numbers and letters backwards without realizing it.

The experiments were performed to find out whether people can learn to see correctly through an optical device that turns the visual world into its mirror image. The outcome of the experiments argues against a theory that has survived for more than two centuries.

According to the theory, visual sensations mean nothing to a newborn infant. He learns to see by touching things, thereby finding out where and what they are. Similarly, an adult who knows that he is moving his hand from left to right, for example, should be able to correct his visual perception by his sense of movement (kinesthesis) when reversing glasses make his hand appear to be moving from right to left.

Just the opposite was found. After wearing the glasses for as little as 15 minutes, test subjects began to feel that their hands were moving from right to left when they were actually going the other way. Even though the subjects were aware the glasses were deceiving them, they automatically trusted their vision.

. . . are spraying sewage on farmlands.

Dr. Louis T. Kardos says that putting sewage plant effluent on farmlands close to cities appears to offer the best method of cleaning streams and rivers of these wastes.

The Pennsylvania State University soil scientist reported on a four-year experiment to convert land to a "living filter." Other benefits of the experiment were increased crop production, recharging of underground reservoirs, and the production of plant crops with significantly higher mineral content.

To make the system feasible, Dr. Kardos said, crops must be harvested to remove nitrogen and phosphorus from waste water. Forest land could not be used.

THE ELECTRONICS STORY

Talking without a voice

ACCURATE synthetic speech is now being produced with the aid of a controllable, computer-generated model of the vocal tract developed at Bell Telephone Labs.

The model, stored in a computer, is actually a geometric description of vocal tract areas as they are shaped to produce various sounds. When synthesizing speech, a researcher can see an outline of the vocal tract displayed on an oscilloscope and, at the same time, hear the sound which corresponds to the displayed shape. By flicking switches and turning knobs at a computer console, the researcher can change the shape and sound simultaneously. Thus, synthetic speech can be improved with visual and aural aids.

In order to synthesize whole words, or syllables realistically, transitions are needed between basic sounds. Shapes corresponding to basic sounds are defined by the researcher at the console. The computer then can automatically interpolate sequences of transitional shapes between one basic shape and another. These sequences correspond to the motions of the human vocal tract when full words are produced. Because the model is similar to the vocal tract, more realistic sounds can now be made with a comparatively simple set of transition rules. Previously, synthesis of transitions was more complicated.

Eventually this information may be useful in devising a more efficient means of encoding and transmitting speech signals.

This is a computer-generated oscilloscope display of the vocal tract showing changes in the position of tongue, lips and pharnyx.

TIPS AND TRENDS

Common measles hit a new 21-year low in 1966. Since new vaccines became available in March, 1963, more than 15,000,000 children have been protected. Only 202,886 cases were reported.

An artificial ocean floor is being used by the Bureau of Mines to test sea-bed mineral drills in a 30-foot-deep tank. It's part of a program to mine the sea economically.

To prevent frostbite next winter, the American Medical Association advises: avoid overexertion and perspiration; don't touch metal; don't smoke, or drink alcoholic beverages.

The high incidence of baby births between three and four AM may be due to a "biological alarm clock," called circadian rhythm, influenced by factors such as light and social surroundings, according to new findings.

An experimental tire developed by B.F. Goodrich Co. can be driven hundreds of miles while deflated without damaging the tire or rim. Driver has control until repairs are made.

Common face bricks have been made successfully from silty clay waste material by the U.S. Geological Survey labs. They fire to an attractive pale orange-pink.

A new "job machine" operated by the National Education Assoc. will soon start matching teacher qualifications and preferences with actual job openings in schools everywhere.

Genetics:
What it will do for the next generation

Biologists are issuing their own startling predictions of how genetics will shape future generations—in the form of warnings. Of course, they often sound like economists warning us of the dangers of prosperity. Their basic idea is that the explosive gain in knowledge in genetics in the last decade means that we will soon have control over DNA, the master plan for the human body. This could result in anything from predetermining the sex of a baby to growing him in a bottle with a patch of chlorophyll on his back and making him live 200 years. "This is going to be the biggest science story of the century—bigger than nuclear fission." ". . . consequences [which] would dwarf those of either atomic energy or the space program." In drawing this parallel biologists are uneasily aware of the double-edged nature of their handiwork. Rather than end up with the troubled consciences of many nuclear physicists, they want the public to start thinking *now* how it will use the new powers over life. And unlike the nuclear age, the genetic age is unlikely to announce itself with a bang. "Practiced in private and in secret on individual genes of individual persons," says Robin Hotchkiss of Rockefeller U., "it will slip imperceptibly into our lives." So often scientists will listen only to other Ph.D.'s. Here's a field of science in which they are not only asking, but demanding, that you take part.

This Science Digest "Special," written by Bruce Frisch, is the third in a series of in-depth reports on broad scientific subjects of current interest. It is designed so that if you wish you can detach it from the main body of the magazine for your use.

Genetics cures hereditary diseases

RONNY D., born Feb. 9, was apparently normal. On February 11 the nurses noticed that he was peculiarly lethargic. Later he failed to gain weight, vomited and had diarrhea. His liver enlarged and he became jaundiced. "Galactosemia," the pediatrician said, and put him on a special diet free of milk. Ronny lacked a single chemical that changes a milk sugar, galactose, into glucose his cells burn for energy. The lack was inherited; nothing could be done about it.

Nor can anything be done about the 1000 other genetic defects that affect about five percent of babies born alive. They are the cretins, diabetics, Mongoloid idiots, cystic fibrotics and the clubfooted. Even worse defects result in the spontaneous abortion of about 20 percent of all conceptions.

But buoyed by a flood of knowledge that has poured out of

Albert Einstein College of Medicine

Littermates, but lower mouse has one bad gene, so almost no muscle.

biology labs in the last decade, scientists are confidently predicting that in the future they will be able to make genetic patches and even make the Ronnies genetically perfect.

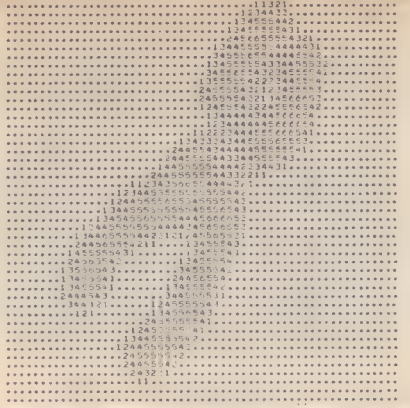
Ronny has only a single genetic error, a lack of one out of the roughly one million instructions for making the body. Every one of the body's cells has a full set of instructions strung along a three-feet-long thread of deoxyribonucleic acid (DNA). In 1953 Watson and Crick came up with a theory of how DNA is made and how it might code its instructions. Within the last two years the structure has been confirmed and the code broken. Here's how it works: DNA is made of a backbone of sugar and phosphate with a series of chemical packets called bases stuck out the side like lollipops on a string. There are four kinds of bases. Each is locked to a base on a

World Health Organization

Old chromosome analysis is done by enlarging photomicrographs of a nucleus, cutting out the chromosomes, and arranging them in order by size and shape.

parallel backbone. Together the backbones and bases form a twisted ladder. When a liver cell, for example, has to go to work making digestive juice, the necessary section of DNA unzips and messenger ribonucleic acid (RNA), similar but with a different sugar, is transcribed from it. The RNA goes out of the nucleus into the cytoplasm where the bases are read off in consecutive groups of three, each three-letter code word instructing the addition of one of 20 amino acids to a long protein chain that makes up the digestive juice. Since there are four bases, here are 64 possible words for only 20 amino acids. Some amino acids are called for by six different code words. But should ultraviolet light, X rays, radioactivity, chemicals or other agents confuse the message, ■ Ronny is born.

Now scientists, led by Edward Tatum, Nobel Prize winner of Rockefeller U., are forecasting correction of such errors at the DNA stage. Working with the bacteria called *E. coli*, biologists have been able to get particular viruses to carry a chunk of DNA from one bacteria to another that lacked it. The technique is now being tried with mammalian cells in culture. Another promising technique induces two cells to merge, combine their DNA, then multiply even when one cell is from a mouse and one from a man. Eventually we may be able to fashion a gene to order. To crack the code, researchers synthesized simple one-word repeating strands of RNA and some slightly more complicated messages. That's a start. Although repair could conceivably be made in the germ cells (see section on *Life*), in many cases it won't be necessary. After all, the fingers don't need to know how to make digestive juices. That the liver does is sufficient. Thus, says Tatum, "the first successful genetic engineering will be done with the patient's own cells, for example, liver cells grown in culture. The desired new gene will be introduced, by directed mutation, from normal cells of another donor by transduction [virus] or by direct DNA



National Biomedical Research Foundation

Computer analysis is 500 times faster than it is by hand (opposite). This is a print-out of what a chromosome looks like to the useful, efficient computer scanner.

transfer. The rare cell with the desired change will then be selected, grown into a mass culture, and reimplanted in the patient's liver." Or, if an errant gene is making a harmful product, it may be enough to switch it off with streptomycin, or by the body's method, with histone (see section on *Aging*).

Tragedy can also come to the children of parents with normal genes. During cell division, DNA forms into 22 chromosomes plus the two sex chromosomes, X and X in females, and X and Y in males. In 1959, it was found that males who suffered Klinefelter's syndrome of sterility, feminization and mental retardation had 22 plus XXY, XXXY, or even XXXXY. Similar discoveries followed. Mongoloids were found to have three number-21 chromosomes. Other diseases were caused by missing pieces, broken or rearranged chromosomes. Some time during cell division leading to formation of the egg and sperm cells, DNA had been misapportioned. Similar accidents during ordinary cell division in the embryo or the adult can lead to partial symptoms, chronic myelotic leukemia, or, possibly, malignant tumors. Although the analysis that led to these discoveries is painfully slow (see photo, above), a new computer method 500 times faster will enable rapid surveys and diagnosis of large numbers of people. A step further is being taken in Denmark where a program of prenatal examination for genetic defects is underway. If a detected defect is serious enough, therapeutic abortion is recommended. With proper warning, preparations can be made for special treatment at birth or a transfusion for a hemophiliac in the womb.

These sudden new prospects are changing the minds of scientists who only recently have been alarmed at the way medicine has been building up the number of harmful genes in the population by keeping defectives alive. Says Nobelist Dr. Peter Medawar, "The rate of accumulation of knowledge is enormously greater than the rate of evolutionary change."

Genetics fights cancer and...

ALTHOUGH as far back as 1909 Dr. Peyton Rous produced cancer in chickens with a virus, no virus has ever been spotted in a human cancer. Today, about 30 different viruses are known to cause animal tumors. Since, to virologists, man is just an animal, many bet viruses are a cause in humans.

A normal virus is a pretty helpless creature. It is just a short length of DNA (or RNA) wrapped in a protein jacket. It cannot breathe, or digest or reproduce. It depends on a host cell to do all these things for it. The protein coat attaches to the membrane of a cell, then injects its nucleic acid inside. The invading nucleic acid tells the cell machinery, which the virus lacks, to make new viruses, then burst open and set them free. In the study of viruses that attack bacteria, it has been noticed that some faulty viruses lack a full set of instructions and cannot dissolve the cell wall, so the bacteria survive. A possibly related clue is that two human viruses that cause animal cancers have slightly less DNA than close relatives that don't. Could a virus short-changed in DNA lack the instructions to take over the cell machinery, but, when attached to the cell DNA, have enough to send the machinery out of control? The added segment of DNA could be inherited, but no virus would be visible. A culprit could be no more than a defective household variety. "There is much to suggest that some human cancers may be the result of infection with ordinary everyday viruses, with no need for the unique or exotic," says Maurice R. Hilleman, director of virus and cell biology at the Merck, Sharpe & Dohme Research Laboratories. Next, from this viral DNA we must find out what code words turn a cell cancerous, for they could help explain many other kinds of cancer. "All suspected causes," says Dr. Tatum, "viral, mutational or regulatory failures, center on cell genetics, and on nucleic acid structure and function."

Sloan-Kettering Institute for Cancer Research

manipulates life

THE deadly virus, possible cause of cancer, shall also be our obedient messenger of mercy. For twenty years, biologists have been using it to carry genes into bacteria that lack them. The same possibilities are coming for humans, says Robin Hotchkiss of Rockefeller U. "One can imagine farms of cultured human cells producing desired markers [genes] and delivering them up to viruses that can profusely replicate them and infectiously transfer them to pregnant mothers, sick patients, and other unlucky beings adjudged by the family doctor to be deficient in something."

Beyond replacement of missing genes will come the improvement of genes. A gene for dumbness, for instance, may be changed to a gene for smartness by a chemical mutagen that acts only on that gene and is carried to the site by man-made molecules in the manner of "seeing-eye-dog RNA" (see *Genetics fights Cancer,* opposite). Or a gene that displeases us may be excised and replaced by one sent in by virus. "It has been argued that these genes for genius and other categories of DNA cannot be pinpointed without elaborate selection tests, but I believe that the art of DNA identification and fractionation will soon bypass the laborious genetic cross," argues Hotchkiss. With genes to command, we may leap the barrier of immune rejection of organ transplants, says Dr. Anton Schwarz of the Dow Chemical Co. "It has been predicted that . . . animal breeds histo-compatible to man could be developed, making available an unlimited supply of replacement organs."

Perhaps only a scientist would dare suggest the more creative possibilities these techniques will open up. "We could, for example, produce an organism that combines the happy qualities of animals and plants, such as one with a large brain so that it can indulge in philosophy, and also have a photosynthetic area on its back so that it would not have to

eat," says Kimball Atwood, professor of microbiology at the U. of Illinois. "It is not inconceivable that there could be humanoids with chlorophyll under their skins so that they would look like the enormous green man on a can of peas." This "genetic engineering" is a long way off, cautions Atwood, but "it certainly is within the realm of the possible and it must be prepared for. A much more likely thing to happen, perhaps within a few years, is the replication of an individual from the genetic material taken from one of his cells, making exact copies of him." It has been done with frogs. The nucleus of a frog egg is first removed with a needle. Then the nucleus of a cell from a donor frog is sucked up into a fine pipette and transferred to the egg. While results are best with undifferentiated cells from a frog embryo, even the nuclei from a tadpole's intestine have grown up into healthy swimming tadpoles just like dad. "If there were any good reason for doing it with a man, it could be done now," claims Atwood. "If you think a particular individual has special genetic traits and you decide you want more of that kind of person, then you can create as many copies as you want." Duplication of women could be even more direct, since a calculated temperature change at the right moment has caused a female rabbit to fertilize one of her own eggs. All daughters, however, did not look exactly like her.

We could create a green man like the one on a can of peas

Since nothing seems impossible, could we grow babies in the lab? Here we get into the problem of gene expression. Every cell contains in the DNA of its nucleus all the information it needs to grow into anything, a hand, a head, a complete body. This was first proved over thirty years ago when the German embryologist, Hans Spemann, transplanted a patch of skin onto a developing embryo and watched it turn into brain cells. The latest, most complete demonstration, by Vimla Vasil and A. C. Hildebrandt at the U. of Wisconsin, was the nurturing of a single cell taken from the stem of a tobacco bush into a complete, flowering plant (right). To perform such a feat with a human outside the womb we will have to master the complex system of chemical signals that turns some genes on and turns others off, that differentiates cells into blood and bone, that keeps noses from being too short and stops arms before they grow too long. At least a first preliminary step has been mastered. Robert Edwards of Johns Hopkins Hospital and Cambridge U. has grown human eggs outside the body up to the point of fertilization. It seems

reasonable, says Bentley Glass of the Johns Hopkins U., that an artificial human embryo might be grown by the end of the century, although not to full term.

Using their imaginations, scientists foresee other benefits from control over expression. Genes might be turned back on to sprout replacements for diseased organs. "The physician of the future," predicts Dr. Schwarz, "may well be able to stimulate natural regeneration of lost extremities." Like lizards. "I have tried to think about what further organs I would like to have," jokes James Bonner of CalTech, "and I have decided that I would like to have four hands, since there is so much for biologists to do."

The ultimate, at least in our old-fashioned way of thinking, would be to create life from simple chemicals in a sort of accelerated reenactment of evolution on earth. About sixteen years ago, Harold Urey, then at the U. of Chicago, began experimenting with mixtures of gases similar to the hypothetical primitive atmosphere of earth. A young colleague, Stanley Miller, extended the work by circulating methane, ammonia and water vapor under bombardent of heat, ultraviolet and electric sparks to produce many amino acids, the basic building blocks of protein. All five of the nucleic acids have been produced at NASA's Ames Research Center by Cyril Ponnamperuma by placing precursor chemicals on a simulated drying mud flat. Two, perhaps three acids are linked up into longer molecules. These reactions speed up considerably under conditions theorized by Clifford Matthews of the Monsanto Co. He suggests that hydrogen cyanide formed in the atmosphere and settled as a scum on the ancient ocean. In such a scum he has found 15 of the 20 amino acids. "We have been making fantastic strides in uncovering the basic chemistry of the life processes and the structure of many of the key components of living organisms," says Charles Price, president of the American Chemical Society. Calling recently for a national crash program to create artificial life, he said, "It seems to me we may be no further today from at least partial synthesis of living organisms than we were in the 1920s from the release of nuclear energy or in the 1940s from a man in space." "Before the end of this decade," claims Glenn Seaborg, chairman of the AEC, "we may be able to create life, a step on the way to making complex organisms." Will we ever be able to create organisms as complicated as humans? Price answers: "I couldn't imagine this would not happen in a century or so."

U. of Wisconsin

B. Frisch

U.P.I.

Genetics

slows aging

WOULD you like to live as long as the oldest organism, a 4,600-year-old bristlecone pine in the California Sierras? In a way, you already are as old as it. Most of the tree is dead. The oldest cells in the living part are probably no older than the oldest human cells. So it isn't surprising that we may soon live much longer than we do now. The "capability [to live 200 years] will be within our grasps in the next several generations," says Dr. James Bonner, professor of biology at CalTech. Genetics should play an important part because many scientists believe aging is deliberately programmed by our master blueprint and control center, DNA. In fact, the older a person is, notes F. Medvedev from the Russian Institute of Medical Radiology, the more likely he is to spawn a child with a genetic defect. The life span is calculated to stop us from having children before these mutations reach a scale harmful to the species. General aging, he believes, is the mechanism for controlling life span. From the shape of mortality-rate curves, a steady rate of aging begins at age 30. How is this decline programmed? Perhaps, suggests F. Marott Sinex of the Boston U. School of Medicine, the auto-immune mechanism is switched on. Through the release of antibodies, we devour ourselves. An opposing, passive theory is that DNA is simply progressively shut off. No more than 10 to 15 percent of the DNA in any one cell is in operation. The rest is pulled together into tight coils by a protein called histone. Researchers at Rockefeller U. can shut down DNA action by adding histones, then loosen the hold of the histone by adding to it acetyl groups. There isn't, however, a special kind of histone for every kind of DNA. Histone seems to be a general tool controlled by a higher authority. Bonner at

Now— keep your teeth forever

by Stanley Englebardt

EVER dream of going through life without losing a single adult tooth? The realization of this dream isn't wishful thinking.

Until recent years dentists didn't know exactly what caused tooth decay and gum infections—and, as a result, couldn't do much to prevent its onset. If a tooth had a cavity, they drilled and filled it; if it was infected, they extracted the tooth and replaced it with a false one.

Now all this is changing. Discoveries within the last few years have provided insight into the causes of decay and infection; new chemical compounds are helping to prevent these diseases; and new dental techniques are proving effective in heading off troubles long before they start.

Among the most important findings has been the pinpointing of the two major causes of tooth decay: an infectious streptococci bacteria; sugar in foods.

The role of bacteria in tooth decay was suspected for a long time. Scientists at the National Institute of Dental Research at Bethesda, Maryland, however, wanted to find out exactly which species of bacteria were involved. If they could focus on a particular organism they could then look for a chemical compound to combat it.

Dental scientists closed in on a streptococcus strain of bacteria but were surprised to discover that these germs could be transmitted from mouth to mouth without the presence of food or existing plaque. Decay can be an infectious disease.

This was a fortunate finding. Bacteria—particularly the streptococcus variety—are extremely vulnerable to antibiotics. Dentists at the Institute infected hamsters with the streptococci germ and raised a formidable crop of decayed teeth. Next they fed the subjects a fluoride gel mixed with penicillin. Result: The antibiotic protected some 15 generations of hamsters from tooth decay, pyorrhea and similar gum diseases.

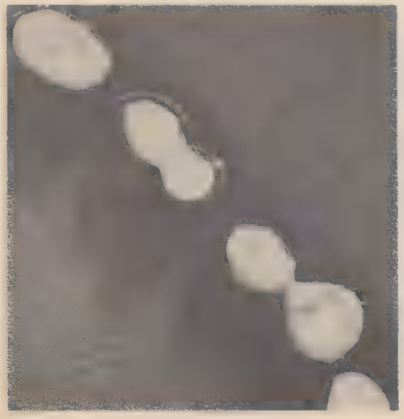
Unfortunately, they couldn't use

(Text continued on page 58)

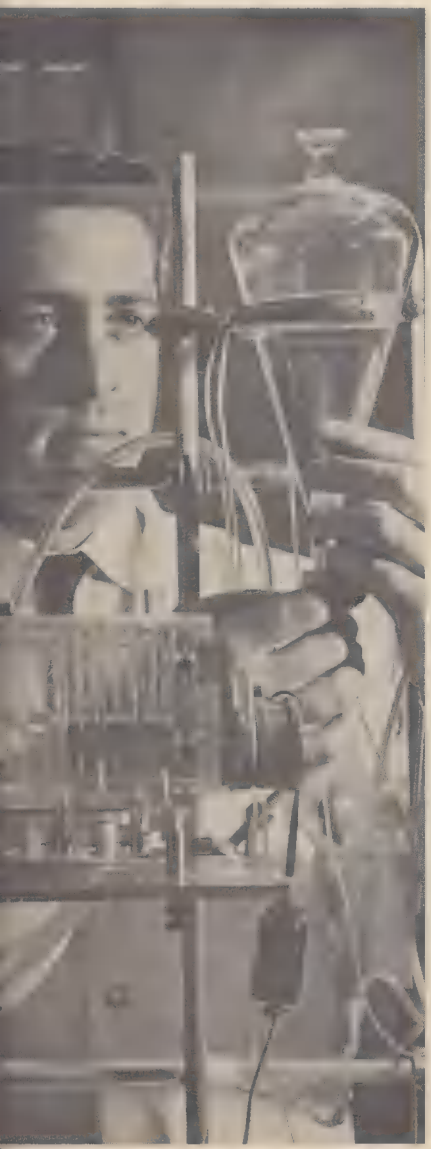
Basic research that will help save your teeth

The iron-lung-like machines are germfree tanks which provide a controlled environment for laboratory animals. Generations of rats have grown up in these steel and plastic tanks untouched by bacteria—and tooth decay. When germs were introduced into sterilized tanks, caries and periodontal disease developed in the germfree rats' teeth for first time.

Magnified 60,000 times by an electron microscope, these fuzzy white things are streptococci bacteria isolated from regular lab rats. They produce caries when brought into contact with germfree rats.



This germfree rat is having his mouth swabbed with a solution of caries-causing streptococci. The special strain of bacteria, once introduced into rat's environment, caused decay in otherwise decay-free rats.



Not only dentists are concerned with the cure of periodontal disease, but scientists of many disciplines are embroiled in research. This biochemist is analyzing amino acids of a protein involved in the disease.

Tooth buds growing in glass are being fed by a research scientist before they are put in an experimental tooth bank. Such a tooth bank is part of a long-range project involving transplantation of human teeth.

These junior high children, aged 11-14, are brushing fluoride into vinyl plastic mouthpieces which they wear for about six minutes daily. The technique is reported to reduce cavities by 80 percent.

(Continued from page 55)
the same antibiotic in humans. While penicillin could prevent infectious tooth decay in people, the body would quickly build up a tolerance to the drug. And while this wouldn't be critical so far as tooth disease is concerned, it might prove serious if the person contacted pneumonia or a similar bacteria-borne infection.

But the answer to this problem is only a matter of time. Many drug companies are already at work on antibiotics that will prove both safe and effective against oral disease. And it seems reasonable to assume that a pill or antibiotic toothpaste will be available in the very near future.

How damaging is sugar?

Another recently pinpointed cause of tooth decay may be much harder to control. This is sugar—particularly the kind found in candies, gum and chewy food. While sugar, too, has been long suspected as a decay-causer, it wasn't until quite recently that researchers learned how dramatically it works in the mouth.

Take a bite of candy and soon the sugar in it combines with saliva to form a powerful acid. Very shortly, this acid is etching the teeth, producing small defects in the enamel. Even a thorough brushing carried out within 30 minutes after eating won't insure against decay.

Finding a chemical to nullify the effects of sugar wasn't too difficult. Scientists at the National Institute quickly discovered that ordinary phosphate—inexpensive and safe—would combine with saliva to counteract the tooth-etching acid. Now several candy and breakfast food manufacturers are planning to add soluble phosphates to their products. But the range of sugar-laden food in the American diet is so great, that this represents only a drop in the bucket.

With all these opportunities to go wrong, how then can you expect "never to lose another tooth?"

The answer lies in the compounds and techniques that have already proved successful in the fight against decay and infection. At the top of the list are the new fluoride chemicals.

When fluoride compounds were introduced with fanfare some years back, they were designed primarily for use on the teeth of children. Dentists in the armed forces, however, realized that they would also work on adults—not only as a "protective" coat around teeth to prevent the onset of decay but also as a chemical treatment for small cavities. Using stannous fluoride, for instance, the dentist today can "paint" these small tooth lesions and literally arrest the spread of decay. Furthermore, there is evidence that the treatment may even strengthen the tooth. The decay must still be removed and replaced by a filling.

Another valuable technique uncovered by the armed forces is "armor plating" of teeth by polishing them with a stannous fluoride paste.

Mineral "armor plate" may prevent cavities permanently

The polishing alone removes many of the surface deposits that could eventually turn into tartar; at the same time, the fluoride compound in the paste combines with the enamel to make the teeth stronger and more resistant to decay.

Present stannous fluoride compounds will soon give way to a better chemical product—zirconium fluoride. Zirconium is an extremely strong mineral which has been used as a glaze for fine china and as a coating for nuclear reactor chambers. With such scratch-resistant qualities, Dr. Joseph C. Muhler of Indiana University decided to see how it would work on teeth. The results were amazing.

By combining zirconium with fluoride, Dr. Muhler came up with a compound that (1) could penetrate even the most microscopic cracks on a tooth's surface, (2) combine with the enamel to form a granite-hard, absolutely smooth surface, and (3) form an "armor plate" after a single treatment that would protect against tooth decay for a month—even when the subject didn't brush or use dental floss during the entire period.

While these and similar chemical compounds have all but eliminated cavities as the cause of tooth loss, you can't relax—not if you want to avoid false teeth. Periodontal disease in adults still looms as the number one cause of tooth loss in the United States.

Periodontal disease starts when minute bits of organic matter work their way between gums and teeth. The gums become red and swollen; a condition called gingivitis develops.

Gingivitis is only a short step away from full fledged periodontal disease. The food and bacteria that collects in tiny pockets begins to harden into tartar. No amount of after-meal brushing can remove this hard placque. It irritates the gum tissues, pulls away the periodontal membranes that nourish the teeth, and, finally, weakens the bone structure that supports and holds the teeth in place. The ultimate result is tooth loss.

Periodontal treatment

Avoiding periodontal disease isn't too difficult—but it does require some effort. This means regular visits to a periodontist or a periodontally-trained general dentist. He will clean out disease-causing pockets and scrape away deep tartar deposits. In some special cases, he may also trim back the gum line, correct the bite, or recommend a dietary change. The objective of all treatments, of course, is to circumvent conditions that may lead to periodontal disease.

What about teeth that have already been infected? Here, too,

New kind of filling material matches shade of tooth enamel

amazing things are happening. All but the most diseased teeth can be retained today thanks to the techniques of endodontia. The endodontist—or an endodontially-trained general dentist—treats diseases of the pulp, or nerve canal. When decay eats its way into the pulp of a tooth, it usually causes severe inflammation of the nerve which, in turn, produces a tiny abscess, at the tip of the root. Until recently, the only answer has been to extract the troublesome tooth and replace it with an artificial one.

The goal of endodontia is to save these teeth. First, the endodontist cleans out the nerve canal (under local anesthesia) and brings the infection under control. Once this is done, he sterilizes the shaft and packs it with a substance called gutta-percha or, in some cases, he may use a snug-fitting silver needle. The idea is to prevent future re-infection. Meanwhile the connective tissues can continue holding and nourishing the teeth. Result: No extraction is necessary—and the treated tooth is usually good for life.

Other innovations

Holding on to your teeth through the use of fluorides and the application of periodontal and endodontal dentistry is only part of the dental revolution:

— There's a new filling material on the market, developed by the 3M Company, that blends to the shade of your teeth. The material is designed primarily for use on front teeth—in place of porcelain fillings. The dentist prepares the cavity as before, and then mixes the grey-shaded substance. Once in the mouth, the material takes on the color of the teeth around it. Within a few hours, it is barely distinguishable from natural enamel. Moreover, it stays that way for months and years, without fading or discoloring.

— The dentist has many new tools with which to do his work faster, more efficiently, and less painfully. Perhaps the biggest boon to the man in the dentist's chair has been the introduction of the high-speed, water-and-air-cooled drill. Revolving 300,000 times per minute, a diamond or carbide steel burr can cut into hard enamel with virtually no noise or vibration. At the same time, high-pressure jets of cold water and air directed at the tip of the burr prevent heat from building up. The job is done faster; the patient feels far less discomfort.

— The anesthesias employed today, too, are vastly improved. The dentist now has his choice of many kinds, ranging from pinpoint anesthesias, which last for only a few minutes, to more generalized compounds, which provide freedom from sensation for a full day. More-

over, the after-effects that used to cause discomfort have been virtually eliminated.

The primary goal of preventive dentistry, though, is to avoid such things as high-speed drills, anesthesias and other operative tools of the dental profession. And the way to do this is quite clear:

"Proper home care is the first step," says the American Dental Association. "Regular twice-a-year dental checkups is the second. Prompt attention to the symptoms of dental disease is the third." Put them all together and you, too, may go through life without ever losing a tooth.

". . . and nature, too, has much to teach us, son."

"Some people can tell what time it is by looking at the sun, but I have never been able to make out the numbers."

"Every snowflake is made into a different shape. I think our weathermen should spend their time more usefully.

"Through the years, people have guessed that Venus might be inhabited by women, dragons or other strange creatures."

"Volcanos give us hot java"

by Harold Dunn

Not only do we get our "coffee" from volcanos, but strange creatures like women might inhabit Venus. These drawings show what results when children mix scientific fact with their brand of fancy. For more bloopers on science, turn the page.

MARK Twain once observed that the most interesting information comes from children, for "they tell all they know and then stop." During the twelve years that I've taught elementary-school youngsters, I've found that their remarks about science can also be hilarious. Here's what I mean:

"A fact was only a theory as a child."

"The axis is only a make-believe line, but the earth still manages to turn on it somehow."

"Naughtical miles tell how far it is to places we shouldn't go."

"Newton noticed that anything at rest tended to remain at rest. For this he grew famous."

"One way to tell for sure if a sweater is made of wool is to hold it over a flame. If it burnt slowly it was wool."

When children turn their attention to the subject of meteorology, youngsterisms seem to come as thick as chalkdust, e.g.:

"Every snowflake is made into a different shape. Personally, I think our weathermen should spend their time more usefully."

"Tornados are usually accompanied by high winds."

"Climate is with us all the time while weather comes and goes."

"When passing through Missouri, a typhoon is really not a hurricane but a tornado."

"The wind is like the air, only pushier."

I couldn't argue with one answer. QUESTION: What do stratus clouds look like? ANSWER: Rain.

Grown-ups can only envy expressions like the following, as charming as childhood itself: "Slush is snow with all the fun melted out."

The subject of humidity has stumped more than one eager young student. Here are four futile but imaginative explanations:

"100 humidities equal 1 rain."

"Humidity is the experience of looking for air and finding water."

"The more a humidity goes over 100 percent, the harder it rains."

"Water vapor gets together in a cloud. When it is big enough to be called a drop it does."

When the youngsters read facts they don't understand, they often let their imaginations take over. I came across the following "imaginary facts" about astronomy earlier this school year:

"Night is when we get on the shady side of the sun."

"Some people can tell what time it is by looking at the sun, but I have never been able to make out the numbers."

"For as long as the moon has been there, it has made a trip around the earth every month. There is not much else to do."

"Through the years people have guessed that Venus might be inhabited by women, dragons or other strange creatures."

"The Nebulus Theory of how the earth got started is still pretty hazy."

Then I don't suppose I'll ever forget this remark by a completely self-assured little girl: "To think that snowflakes fall from stars is

"Proclivity is a natural tendency, especially at the edge of a cliff"

crazy. Everybody knows that snowflakes have SIX points."

One lad had the right information but the wrong answer: "In order to know that the moon has gravity I need only look at the tides. Somehow this proves it to me conclusively."

Three of his classmates reached these conclusions:

"The earth holds on to everything with its grabity."

"There is a tremendous weight pressing down on the center of the earth. Because of so much population stomping around up here these days."

"Proclivity is a natural tendency. There is a man standing on the edge of a cliff. There is a strong gust of breeze. The rest is proclivity."

One intense student took a gratifying interest in the subject of chemistry. In the five-page report that resulted, you might know there would be a few unique ideas. Here they are:

"To most people solutions mean finding the answer, but to chemists solutions are things that are still all mixed up."

"The best thing carbon monoxide is good for is running away from."

"We say the cause of perfume disappearing is evaporation. Evaporation gets blamed for many things people forget to put the top on."

Sometimes a new bit of information is turned upside down in a child's mind and comes out like this: "There is nothing to keep a liquid from changing to another state. The Mississippi River, as we all know, does not have to stay in that state alone."

Additional comments on the subject of water:

"In making water it takes everything from H to O."

"Rain is often spoken of as soft water, oppositely known as hail."

"The smallest particle water can be divided into is the drop."

"Heavy water is with ships in it."

Here's another wild guesser at work: "The water cycle is a thing on which a person can ride on the water by pedaling along. I don't believe it has been invented yet."

Obviously, many of the kids' boners have a devastating logic. Ask a child to define a vacuum and you will usually come up with a delightful bit of whimsy similar to these definitions:

"In a vacuum is to be found a great deal of nothing."

"A vacuum is an empty place with nothing in it."

"Vacuums are nothings. We only mention them to let them know we know they're there."

"There is no air in vacuums. That means there is nothing. Try to think of it. It is easier to think of anything than nothing."

Most of the kids are fascinated by things that are small—be they puppies, turtles, goldfish or molecules. Her are three of my favorite comments:

"While molecules in gases and liquids bounce around from place to place, in solids they just lay there and vibrate."

"Some oxygen molecules help fires to burn while others choose to help make water, so sometimes it is brother against brother."

"Molecules are constantly bumping around each other in the air. There is really quite an overpopulation of molecules."

"Even smaller than molecules are the atoms. Inside the atoms are electrons and protons. Electrons carry the negative charge while the protons provide the affirmative."

After carefully mixing together his knowledge of geology and American history, one chap came up with this statement: "It now appears pretty sure that Maine is slowly sinking. When we first noticed this we fought Spain, thinking they were causing the sinking of Maine."

Here are some other geological observations that I've saved through the years:

"Volcanos give us hot java."

"Lime is a green-tasting rock."

"Many of the dead animals of the past changed to dirt or oil while others decided to be fossils."

"Rocks are gradually softened through aging. The first hundred years of a rock's life are the hardest."

Here's a wonderful example of a child's reasoning: "Many holes in the Pacific Ocean could be famous as mountains if they were not upside down."

Other thoughts on the subject of our earth:

"Aristotle thought the earth was shaped like a spear."

"The worst thing about latitudes and longitudes and equators is that they are only imaginary places. People should not have to fill up their minds with imaginary places. We should use all our mind's space for knowledge about real places."

"Latitude makes it possible to have imaginary streets in the ocean without having to spend the money to build them."

A couple of years ago there was a tiny moppet in my class who had a delightful way of expressing her thoughts. Here's how she summed up her feelings: "From now on I will put both gladness and wonder in my same thought about science."

Me, too.

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I prescribe . . .

for coughs and colds

by Joseph D. Wassersug, M.D.

Most persons with mild respiratory infections never consult a doctor about their symptoms and they get along quite nicely with whatever "cold" concoctions attract their fancy at the druggist's or at the supermarket. That's perfectly all right with me. The majority of respiratory infections are mild, self-limited and get better with nothing more than the passage of time.

On the other hand some coughs and other respiratory symptoms are caused by such diseases as pneumonia, emphysema, heart disease, pulmonary embolization, collapsed lung and cancer. In these cases the need for a doctor may be urgent. Since the patient can't always know from the way he feels just how sick he really is, it's usually best that he consult his doctor without too much delay.

Most respiratory ailments are not progressive or fatal and, in most of these, the doctor can speed relief, effect a cure, or relieve the symptoms.

Since the great majority of respiratory diseases are due to infection, germs and viruses are my biggest problem. Since there are already more than 75 known different viruses that can cause respiratory disease it is obviously impossible to keep track of all the different viruses all the time.

In my mind, to simplify matters, I classify all the respiratory microbes into three groups. First, there are the tiny viruses like influenza. These do not respond to the usual antibiotics but some of these virus infections can be prevented or modified by "flu shots" late in the fall or early in the winter.

I follow the recommendations of the U.S. Public Health Service in this respect. I urge all patients who are over sixty and all those who have disease of the heart or lungs to be adequately immunized. For

the younger, healthy adults immunization is optional; I give them "flu shots" if they want them but I don't try to "sell" them on it.

In the second class is an odd group of larger viruses called Mycoplasma pneumoniae. These have also been known as Eaton agents and pleuropneumonia organisms. Most of them respond to treatment with erythromycin or tetracycline. I use one or the other of these antibiotics depending on the patient's earlier experience with them. Since some tetracyclines are relatively inexpensive, I may try them first.

The ordinary germs that cause pneumonia, expecially the pneumococcus, are in the third group. These respond to penicillin, sulfa, tetracycline, penicillin synthetics and semi-synthetics. Since practically no pneumococci are resistant to penicillin, this is the antibiotic of choice in these cases unless the patient is sensitive or allergic to it.

What antibiotics I choose depends on the history, the clinical examination and, when possible, the X-ray and sputum findings. If the patient has been ill for only a day or two and if his illness has begun with a high fever and a shaking chill, I usually administer penicillin by injection and tablets. An acute onset with a shaking chill usually means the patient has a "lobar" or pneumococcal pneumonia. For this penicillin is best.

Most respiratory infections nowadays are not of the lobar type but are bronchial, either acute bronchitis or broncho pneumonia. In these cases the onset is usually more gradual and the more severe respiratory infections may be a sequel to a common cold or some other mild disease. Although some of these infections may respond to penicillin, I generally prefer the tetracyclines.

When the disease is chronic the infection may be mixed and when there are a variety of germs in the lungs, I believe, it is better to use a "broad spectrum antibiotic" such as the tetracyclines. Other doctors may disagree with me on this point but, over the years, this approach has been a practical and successful one for me.

There are still other types of pneumonia that do not fall into any of the above categories. For example, "staph" pneumonia may be exceedingly serious and need special antibiotics for treatment. Klebsiella pneumonia has characteristic sputum and X-ray findings. It, too, requires special antibiotics. In any of these cases prompt diagnosis and prompt treatment may be life-saving. If you are sick with a bad "cold" don't delay in calling your doctor. You may have pneumonia.

In the older age group especially, the most common condition the doctor has to treat is chronic bronchitis. Usually the patient is a cigarette smoker who burns up at least a pack a day. Some of these patients have had many attacks of flu and bronchitis and pneumonia earlier in life. Some may even have scars from old TB infections. All have a chronic cough which is usually, but not always, worse in the

Best cough mixture is Mom's remedy of warm milk and honey

morning. Some light up a cigarette just as soon as they get out of bed. They hack and cough, cough and hack but continue to smoke.

My advice to these patients, first, is to stop smoking. This, I know, is easier said than done. However, if it isn't done, the chronic cough will continue in spite of all other efforts to stop it.

In addition to this advice I usually prescribe an antibiotic, most often a broad-spectrum antibiotic such as the tetracycline. I also prescribe an expectorant cough mixture. Truth is that not all cough syrups labeled "Expectorant" live up to the manufacturer's claims.

Matter of fact, most commercial cough syrups—and many prescribed by doctors—are worse than useless. Cough mixtures that contain codeine, antihistamines, codeine derivatives and other cough suppressants dry and thicken the phlegm and make expectoration of mucus more difficult.

The simplest expectorant cough mixture is a warm sweet drink. Mother's old remedy of honey, warm milk and butter is really pretty good. Warm sweet tea or coffee is also acceptable. If iodides, glyceryl guaiacolate, or ammonium chloride (or citrate) are added, the effectiveness is enhanced. If a bronchodilator such as ephedrine is put into the mixture the results are still better. Fortunately a few drug manufacturers do make a real expectorant cough mixture. In special cases I write individualized prescriptions for the druggist to compound behind his own counter.

In younger persons a chronic cough may be due to bronchiectasis. This is a condition in which there is some distortion and dilatation of segments of the bronchial tubes. It may follow pneumonia, be related to a congenital abnormality or be associated with cystic fibrosis (also called mucoviscidosis). These patients can be helped not only by long term use of expectorants and antibiotics but by a technique called postural-drainage or postural exercise.

In postural drainage the patient is asked to lean over a chair on the edge of the bed with his head way down on the floor. In my office I not only describe the technique verbally to my younger patients but actually 'act it out" for them. The reason that postural drainage works is that bronchiectasis usually affects the bottom of the lungs. Unless the patient coughs with his lungs "upside down" most of the phlegm remains in the chest. By tipping him over, much more phlegm can be expectorated than is ordinarily possible.

In the past few years much has been written about emphysema. Most of the stuff in the popular press is nonsense and has only

served to scare innocent and gullible persons into running anxiously to the doctor. There are all shades and degrees of emphysema. Some are mild, and are consistent with average or better-than-average longevity. Some cause increasing shortness of breath, chronic cough, wheeze and disability.

In emphysema the lungs (or a part of the lung) are over-distended, filled with too much "stale" air that is trapped inside. Although medical scientists are still debating over the precise pathologic mechanisms that cause emphysema, it is undoubtedly related to chronic cigarette smoking, air pollution, chronic lung infections, and, perhaps, many other factors as well.

To cure emphysema one should not start when the patient is old and gasping for breath but when he smokes his first cigarette or when he has his first attack of bronchitis. In other words, I think it is easier to prevent emphysema early in life than to cure it when the patient is in the advanced stages of the disease.

Most of the patients who come to my office fearful that they may have emphysema usually have been scared for no real reason. Some have been frightened by an X-ray report. The truth is that only a small percentage of emphysema can be accurately diagnosed from the X-ray film alone. Conservative and experienced radiologists are hesitant to make this diagnosis without some correlation with the patient's clinical status.

Others have been "diagnosed" by some breathing tests or lung function studies. Admittedly lung function studies may help but they are not always the whole answer. For the patient who is needlessly worried or frightened my only prescription is reassurance.

For the patient who really has emphysema, I try to adjust my treatment to the severity of the disease. I may use antibiotics, breathing exercises, inhalant drugs, expectorants or corticosteroids.

If special exercises are needed to improve lung function, I give the patient printed instructions. If inhalants are necessary, I instruct in their proper use. If I administer antibiotics or corticosteroids, I try to follow the patient carefully for evidence of improvement or for the advent of complications. It takes time and patience to improve breathing ability.

Although tuberculosis is not the bugaboo it was a decade or two ago, it is still a major disease capable of damaging the lungs and causing death. No case of TB, not even the mildest, can be taken lightly until it is ascertained that the disease is arrested or inactive.

Prolonged hospitalization is no longer necessary in treating the majority of the cases, but medication is. The three most important medicines are isoniazid, streptomycin and para-aminosalicylic acid. Isonizid tablets are cheap and are effective. Streptomycin must be given by injection. Para-aminosalicylic acid may be valuable in preventing

Cough may be due to failing heart and circulation

the emergence of resistant TB germs but I don't like it and hardly use it. It is at best a weak anti-TB medicine but it can cause severe stomach upsets and even liver damage. It's about time it was replaced by something better.

Often enough a patient's cough is not due primarily to disease of the lungs but to a failing heart and circulation. Blood flow in and out of the heart in rhythmic squirts. A steady regular rate and rhythm is most efficient. If the heart becomes too rapid or too irregular (or both) it can't get rid of all the blood that flows into it and the blood then stagnates in the ankles (swollen ankles) or in the lungs (cough and phlegm). This condition is called "cardiac failure" or "congestive failure." It produces such symptoms as shortness of breath, "cardiac asthma" and cough.

In most cases the best treatment of cardiac failure is to digitalize the patient. This means giving the patient a rather large "priming" dose of digitalis or one of the several purified digitalis drugs and then carefully adjusting the dose later for each individual's special needs. Digitalis slows and strengthens the heart. It is especially valuable if the heart is rapid or irregular or both.

Patients who are coughing because of cardiac failure can often also be helped by restricting sodium (salt and salt-like compounds) and by using diuretics which improve the function of the kidneys. The heart, the lungs and the kidneys normally act like an efficient three-man team. If any one of the team is weak the total effort can be improved by helping one of the other two.

Today doctors have wonderful and effective diuretics. I use thiazides, triamterene, spironolactone, furosemide and mercurial injections, whichever is simplist, has least side effects and is most efficient in any given case. I usually start with thiazides or thiazide-like drugs. For most persons they are still, I believe, the best.

Sometimes a cough is due to a serious condition like cancer of the lung. This occurs most commonly in middle-aged men who are heavy smokers. Cancer of the lung is best detected especially in its early stage by an X-ray of the chest. When there is any doubt, I hospitalize my patients, have sputum tests made and have them bronchoscoped.

Since lung surgery is almost as safe as abdominal surgery, I do not hesitate recommending an operation when I think it will prove successful.

Treating coughs and colds can present many tricky problems. If cough medicine hasn't "cured" your cough in a couple of weeks, see your doctor.

Inventions for the bathroom

by Stacy V. Jones

In 1575, Queen Elizabeth I and her ministers granted a patent for the transmutation of metals, which proved to be impossible, yet they refused one to John Harington for his invention of the water closet. Historians have noted with regret that this action meant a long delay in introducing the W.C.

Nearly 400 years later, the U.S. Patent Office cannot be accused of refusing to recognize bathroom creativity. Hardly a week goes by without issuance of letters patent for a toothpaste dispenser. Most of them are to be screwed to the wall near the washbasin, and their purpose is to substitute mechanical for finger pressure in getting the paste out of a tube onto a brush.

Numerically, the squeezer patents rival those for coat hangers, garbage can stackers, mail box signals, and the trick golf clubs with sights. A soap company executive once said that he was offered every year 500 ideas for containing, capping, extruding and otherwise dispensing toothpaste powders.

In the W. C. field, where the records disclose many prosaic advances in flushing and venting, a recent imaginative contribution has gone virtually unnoticed. This is the vibrating toilet seat patented by Thomas J. Bayard, proprietor of a large Chicago hair styling salon.

The inventor plans to offer his seat to medical institutions and the general public, and to make it available to hotels and motels for coin operation. Its purported benefit: it relaxes you.

In a closely allied category is the nursery toilet trainer, patented by a Californian, that rewards a child automatically by the sound of music. William R. Hix, Jr., of Ceres, the patentee, says that the music box also signals that junior has fulfilled his responsibility.

The modern American toilet was a special target of Prof. Alexander Kira in a recent, encyclopedic report, *The Bathroom: Criteria for Design* (Center for Housing and Environmental Studios, Cornell University, Ithaca, 1966). His chief complaint was its height for, he said, the natural and physiologically sound posture is the squat.

The squatting position is assumed by primitive peoples, and indeed is followed by most of the world. "We represent only a small percentage of the world's population," wrote Kira, "and a percentage that may be said, in the absolute sense, to be wrong insofar as we have allowed society to interfere with our biological functioning."

Prof. Kira found it ironical that virtually all of the "squat plates"

(Continued on page 74)

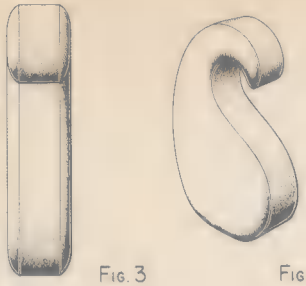


FIG. 3 FIG. 1

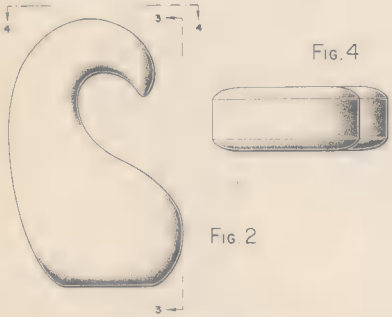
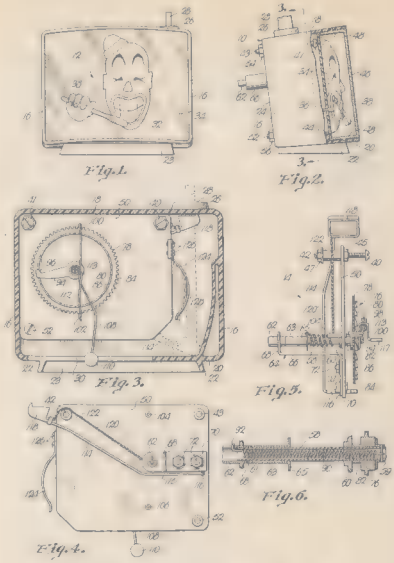


FIG. 4

FIG. 2

Hang-up soap bar



Animated tooth brushing timer

The four articles on this page were chosen from among thousands that are annually submitted to the U.S. Patent Office. The views illustrate the invention from different perspectives with each point of operation carefully enumerated for the patent investigators. Detailed explanations of how the articles function and the step-by-step development accompany the line drawings.

Whale soap receptacle

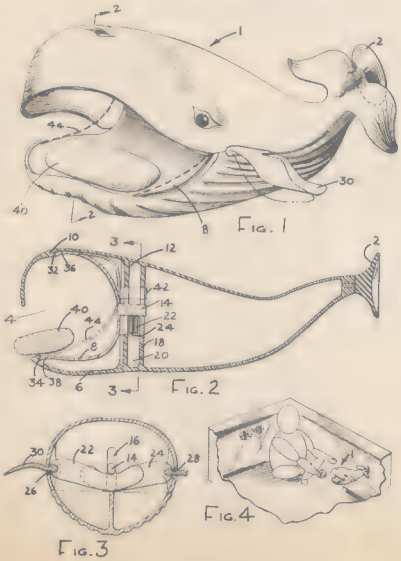


FIG. 1

FIG. 2

FIG. 4

FIG. 3

Toothbrush/toy gun

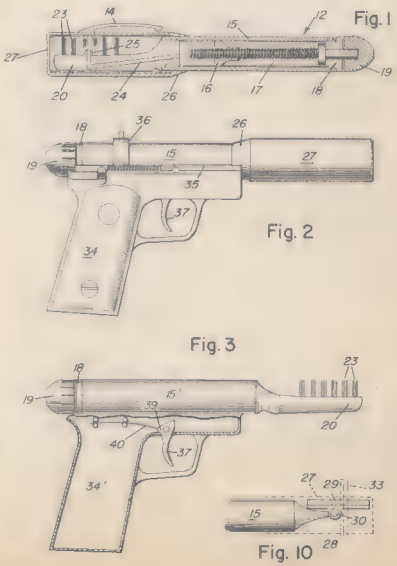


Fig. 1

Fig. 2

Fig. 3

Fig. 10

Common in Europe, bidet is novel in U.S.

Lower seat accommodates the natural squat.

(Continued from page 72)

used elsewhere in the world are manufactured in the "civilized" western countries.

Realizing that some compromise would be necessary, he recommended that the low point of the toilet seat pad be set at 9 inches.

The Kira book has had a strong impact on plumbing industry thinking. American-Standard, which was a joint sponsor of the seven-year study, introduced a streamlined water closet but declined to follow Kira's recommendation of a seat just 9 inches high. The company felt that the public was not yet ready for it.

Prof. Kira and his associates put forward numerous suggestions for modernizing the basin and the bath tub. In the last few years, inventors working independently have done their best to make washing up more efficient and pleasurable.

For example, Robert L. Knight of Coalgate, Okla., patented machinery to automate the scrubbing of the tub. It is designed to be kept in a wall recess until needed. Knotted cords, threaded through holes in a bucket, constitute miniature flails. When the bucket is lowered into the tub, detergent is released, water and the motor are turned on, and the bucket moves up and down the tub surface, as the flailing cords erase the ring.

To meet the difficulty of scrubbing the back, Rolley L. Briggs of Fargo, N.D., has devised a rotary brush to be fixed on the shower stall or on the wall above the tub.

An elevator can be used to get in and out of the tub

The bather stands with his spine against the brush and twirls it first in one direction and then in the other by pulling the ends of a cord.

As a bathroom aid in weight reduction, Owen G. Morehead of Clinton, Iowa, offers a health belt. The user, standing in a tub or shower, buckles it on and screws a hose onto the hot water faucet. The belt keeps the midriff soaked and warm. The inventor suggests that the wearer engage in concurrent kneading or bending exercises.

Inventors have provided many mechanical aids to body cleansing and personal grooming. Elevators get the infirm safely into and out of the tub; the electric toothbrush is almost as common as the electric razor, and Prof. Kira has even chronicled an electric toothpick. Then there are dryers, vaporizers, whirlpool agitators and clippers for those who prefer home haircuts.

A patent was recently awarded for a safety razor with a radio in the handle to report whether the user is getting a smooth shave.

John H. Worthington of West Lafayette, Ind., explains that with his patent the shaver does not need to feel with his fingers for any whiskers still standing. If the cheek is smooth, the only sound is a soft whisper, but if any bristles have escaped the blade, the loudspeaker emits a noise like static.

A man in Astoria, Ore., who reported that he had an extremely tough, heavy beard and a tender skin, offered his fellow shavers a beard softener. Raymond L. Propst had been forced to prepare his whiskers by draping a bath towel over his head and forming a canopy over the washbowl, which he filled with hot water.

Covering bottom of tub below are slip-resistant circles called Stan-sure. Right, safety net for scales keeps baby in line.

His solution to the problem was a plastic steamer that fitted under the chin and around the face. The user could fill the lower part with hot water and need only hold the vessel in place for a minute or two, and then give himself a once-over.

Americans are always concerned with the bathroom safety of their children, and with ways to encourage them in hygiene. Dr. Sheldon N. Feinberg, a practicing pediatrician-inventor, could watch no longer as infants teetered uncontrollably on unguarded baby scales. So he and an associate, Theodorus H. van der Schoot, recently patented a safety net. The patent is assigned to Medical Pragmatics, Inc., Hillsdale, N.J., of which Dr. Feinberg is president.

Burp seat

Eva Brooker is inventor of another safety net—for the diaper table. If mother is called away to answer the telephone, the net automatically extends itself from the table edge to catch the baby.

Another mother's helper that might serve either in or outside the bathroom is the burp seat invented by Glenn D. Gaskins of Clinton, S.C. The fixture is not a seat in the usual sense; the baby rests on his stomach and chest at about the angle he would occupy on a parental shoulder. The infant has a complete view of his surroundings, so that his mind will be occupied as he is relieved of gas.

To promote childish activity in the bath there is the plastic whale designed by Sonia Adelson of Rose Bay, Australia. The whale may be attached to the side of the tub with a suction cup at the end of its tail, or may be allowed to float around. It has a large open mouth carrying a cake of soap.

For little girls, Prudence Shaw of Lyons, Ohio, has devised a doll with a head of hair that can be dipped into a pan of water and shampooed.

Considerable ingenuity is shown in devices to charm children into brushing their teeth. A toy dog, invented by William and Gilbert Krasnoff of Brooklyn, holds a pair of toothbrushes between its ears and paws. The child selects a brush and squeezes the dog, extruding toothpaste through its nose.

Another encourager is a combination fountain toothbrush and toy pistol, the concept of Shelby R. Blackmon of Little Rock, Ark. A supply of dentifrice is carried in the gun. After removing the cap, the young marksman pulls the trigger, exuding paste onto his brush and making popping sounds. It is suggested that the gun be carried in a holster.

One device sets a good example. When its spring is wound, a timer with a clown's face moves a real toothbrush up and down over simulated teeth for the desired period, and the watching youngster can emulate the pace. The inventor is Walter V. Stone of Topeka, Kan.

The family tub often accommodates the family dog. Robert E. and Jean L. Whitney of Minneap-

olis remark that it is necessary to bathe pets frequently but that a wet animal is obnoxious in the home. They have patented a pet drying bag with an attached air hose.

The patent drawings show a dog zipped up in the bag with its head protruding through an opening. The hose introduces air under pressure from a hair dryer or vacuum cleaner.

The plumbing industry, with the aid of the patent system, now offers the American public a variety of auxiliary equipment— bathinettes, bidets, home urinals, denture soakers, saunas, and even His and Her tubs with goldplated fittings. Soap comes in aerosol cans or in cakes that are shaped so they hang up.

Yet with all this, says Prof. Kira, the average bathroom is hopelessly antiquated and inadequate.

Bathroom inventors would do well to read his $7 book, not only because it sweeps away taboos and throws the light of science on the perineal area, but for its summary of what the consumer wants. The innovations suggested by a thousand householders who were interviewed range from a basin designed for sliding the baby in and out, to a window seat for cutting toenails.

"Let them laugh, I think you've got something there."

Nestled high in the other-worldly volcanic scenery of Hawaii is Lake Waiau, a tiny heart-shaped lake that may contain a "historical record" stretching back to the Ice Age.

This lake is a lab

AN "undefiled" lake on the Island of Hawaii is expected to provide clues to the volcanic history of the island as well as to changes in climate and plant life during the last 30,000 years, according to earth scientists of the U.S. Geological Survey and the University of Hawaii.

Drs. Meyer Rubin, A. H. Woodcock and R. A. Duce recently described the probings being made of sediments on the bottom of Lake Waiau, a tiny lake situated in north-central Hawaii, nearly 13,000 feet above sea level.

"This shallow, heart-shaped lake, located on the slope of the inactive volcano Mauna Kea and scarcely more than two acres in size, is a perfect outdoor laboratory," said Dr. Rubin. "It's been a natural trap for sedimentary materials during part of the Ice Age and ever since."

The geologists probed the bottom of the lake and found that nearly 25 feet of sedimentary materials had accumulated since the lake was formed—probably in late Pleistocene time (about 30,000 years ago). Sampling the top six feet, they found the sediments to be complex stratifications with beds of black and gray volcanic ash, but containing enough organic matter for dating the various volcanic ash layers with radioactive carbon dating techniques.

Part of the organic material consists of remains of one-celled plants and animals which impart red and olive-green colors to the sediments. The layers also contain dust consisting of pollen from vegetation and ash from the volcanic eruptions.

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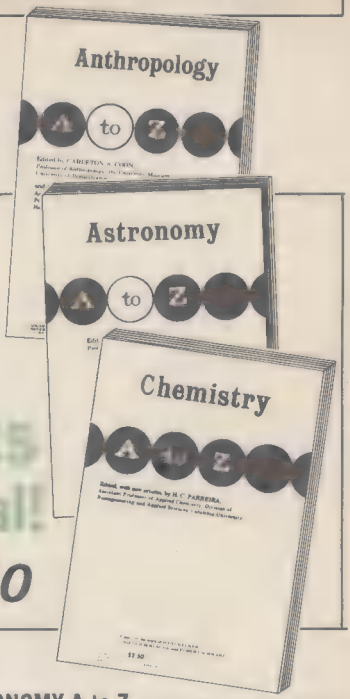

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PLEASE EXPLAIN

KFS

Where do stars come from?

What is cosmic dust and where does it come from?

According to current astronomical views, the galaxies were originally vast conglomerations of gas and dust, which slowly rotated, broke into turbulent eddies and condensed into stars. In some regions, where the stars formed thickly, virtually all the gas and dust found its way into one star or another. Little or none was left in the spaces between. This is true in globular clusters, in elliptical galaxies and in the central core of spiral galaxies.

In the outskirts of the spiral galaxies, the process was much less efficient. Stars formed in fewer numbers and much gas and dust was left over. We are in the spiral arms of our own galaxy and we can see dust clouds making dark patches against the glow of the Milky Way. The center of our own galaxy is completely obscured by such clouds of dust.

The material out of which the Universe is formed is mostly hy-

drogen and helium. Helium atoms have no tendency to stick together. Hydrogen atoms do, but only in pairs, forming hydrogen molecules (H_2). This means that most of the material between the stars consists of separate small helium atoms or separate small hydrogen atoms and molecules. These make up the interstellar gas that forms the bulk of the matter between the stars.

Interstellar dust (or cosmic dust), present in much smaller quantity, is made up of particles that are very tiny but much larger than single atoms or molecules, and must therefore contain atoms other than hydrogen or helium.

Next to hydrogen and helium, the most common type of atom in the universe is oxygen. It can combine with hydrogen to form hydroxyl groups (HO) and water molecules (H_2O). These will have a distinct tendency to cling to any other groups and molecules of the same sort that they may encounter, so that gradually tiny particles made up of many millions of such molecules are built up. Hydroxyl groups and water molecules may make up a major part of the cosmic dust. It was only in 1965 that hydroxyl groups were actually detected in space and their distribution began to be studied. It is hoped that from such studies we will be able to learn things about the structure of galaxies we did not know before.

Cosmic dust must also contain atom groupings made up of atoms even less common than oxygen. Atoms of calcium, sodium, potassium and iron have been detected in inerstellar space, through the light they absorb.

Within our solar system, there is similar dust, contributed perhaps by comets. Outside the visible limits of our solar system, there may be a shell of large numbers of comets, some of which (through the gravitational effects of nearby stars, perhaps) drop down toward the sun. Comets are loose conglomerations of tiny solid fragments of metal and rock held together by a cement of ice plus frozen methane, ammonia, and other such materials. Each time a comet approaches the sun, some of its matter boils off and tiny solid particles are freed and scattered into space in the form of a long tail. Eventually, the comet breaks up altogether.

Countless comets have broken up in the history of the solar system and, as a result, the inner reaches of the system are littered with dust. Earth collects these dust particles ("micrometeoroids") by the billions each day. Space scientists are interested in them for a variety of reasons; for one thing, the larger micrometeoroids might present a hazard for future astronauts and moon-colonists. —*Isaac Asimov*

How long do elephants live?

Says the British publication *New Scientist*, "The longevity of elephants, like the news of Mark Twain's death, tends to be grossly exaggerated." The magazine awards the record to a female elephant that lived at the Sydney (Australia) zoo

until it had to be destroyed because of senile infirmities at the age of 69. The Boston zoo had a speciman that reached the age of 50. Elephants probably live longer in the zoo than in the wild.

Oddly enough it is birds, creatures that would seem to need a great deal of space, that do best in the confines of a zoo. The *New Scientist* mentions a breeding pair of golden eagles which lived in a small cage for more than 40 years, and they note that the oldest inmate of the Basle zoo is a male condor, bought in 1900.

Says the publication, "The record shows that large carnivores can be kept over 20 years, salamanders and reptiles for 50 years and birds of prey up to 100."

Why does a teapot drip?

People thought for a long time that a teapot dripped because the tea "adheres" to the spout. An old folk remedy is to put a dab of butter under the spout. If the "teapot effect" were really caused by adhesion such a water repellent between the liquid and solid would check the dripping. Besides getting butter on table linens, it doesn't work.

As it turns out, there is not one teapot effect, but two. The first can be seen by tipping a teapot slightly, while filling it from the faucet.

When the water comes out of the spout slowly enough, it clings to the spout and dribbles down the side.

Should the water's velocity be increased sufficiently, the result is a nice "ballistic curve" falling away from the teapot. In between this arc, ideal for pouring, and the first effect lies the second. The stream splits—some clings to the spout and some pours out in a stream curving backwards towards the pot.

The first effect is explained in this way. As the water falls, gravitational potential energy, the energy in the water by virtue of its being raised up above sea level, is converted into kinetic energy, the energy of the water's motion. Not all of the kinetic energy is "straight down motion," but some is rotational. The rotational motion comes about because of the nontrivial fact that water is "wet." This wetness, or viscosity, means that the layer of water nearest to the solid teapot doesn't flow at all while proceeding away from the pot, the water flows faster and faster. This "velocity gradient," as it is called, causes swirls in the water, or vortices, which are the rotational motion advertised above. These vortices keep turning the fluid in toward the wall, pressing it against the surface of the teapot. It is because of this that the tea "sticks" to the spout.

The second effect, that of the "anti-ballistic curve," is still something of a puzzle. Here there is no solid wall to give rise to vortices or for vortices to press against.

Engineers have used these effects to develop sophisticated burner nozzles, novel jets, and hovercraft, which promise a saving of power. But so far, no one seems able to make a truly dripless teapot.

—Margaret L. Silbar.

THE HUGH DOWNS COLUMN

The new voice of science

WHAT has become of the stance of Byronic sadness so dear to scientists of yesterday?

The mechanistic universe, running down, dominated by the second law of thermodynamics, in which the presence of life was an embarrassment (since it appeared to defy entropy), gained sophistication through the quantum theory and relativity. These did away with mechanism, but made an eventual heat-death for the universe no less certain. However, in granting eons of reprieve, they set the stage for a still more sophisticated outlook, only now emerging and as yet of hazy and unfamiliar shape.

As the 17th century had questioned geo-centrism, the 18th century had questioned divine control of the universe, and the 19th century had questioned the mechanistic concept and the existence of the ether, so the 20th century has questioned conservation of mass-energy, the atomicity of matter and any and all concepts of objectivity as concerns scientific "truth" (preferring to judge hypotheses by how well they serve specific problems).

Every age seems to take fiendish delight in pulling the rug from under the theories that gave comfort to the preceding age.

Scientific advance has robbed us of our cosmos-origin myths, of absolutes in space frameworks and time scales, of up and down, of the immutability of laws we extract and finally of our very quest for scientific truth. To some, this has seemed as though science has at last tured around and pulled the rug from under itself. To those who made of science a surrogate god, this is indeed the case. Science, if pursued to its lair, will refuse to yield something it does not have—something we have wished onto our

image of it. And if we refuse to give it up, that image, once cornered, will destroy itself.

In the process of growing up, humanity seems to insist on setting up its idols wherever it seems safe to do so: in the forest, on the hearth, in temples under the protection of powerful priesthoods, abstracted into social rituals and games, embedded in imagined 'laws' of the universe, or in the pious act of truth-seeking. Science will not let itself be used in this way. When the ruthless world finally teaches us the futility of even objective truth-seeking, it forces us to look in the one place we have been afraid to look—the one place with no room or use for myth or images or idols.

We are suddenly the aging Don Quixote confronted with foes holding not weapons but mirrors. We must now face ourselves and we'd rather not. In any case, we may soon have to learn that there is nothing "out there"—God, nor principle, nor laws, nor any Imperishable External to cling to and on which to hang hope or blame—responsibility or excuse. And from this painful encounter something new and immense is taking shape.

Listen to the change of voices in a generation:

Yesterday, Bertrand Russell: "... All the labor of the ages, all the devotion, all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system, and ... the whole temple of Man's achievement must inevitably be buried beneath the debris of a universe in ruin—all these things, if not quite beyond dispute, are yet so nearly certain, that no philosophy which rejects them can hope to stand."

Yesterday, Sir James Jeans (in *Mysterious Universe*): "Physics tells the same story as astronomy. For independently of all astronomical considerations, the general physical principle known as the second law of thermo-dynamics predicts that there can be but one end to the universe—a 'heat-death' in which the total energy of the universe is uniformly distributed, and all the substance of the universe is at the same temperature. This temperature will be so low as to make life impossible. It matters little by what particular road this final state is reached; all roads lead to Rome, and the end of the journey cannot be other than universal death."

Yesterday, Albert Einstein: "The Lord God does not play dice!" commenting on probability-domination of certain physical measurements.

Descartes believed there could be no connection between mind and matter. Darwin defined the forces that changed species but failed to grasp the results of those forces having developed intellect which begins now to feed back by directing and controlling evolution from here on.

Now a new note sounds—a steady diapason under what appear at first as diverse utterances. Hear

"Mankind will have time enough to attempt all things, gather all knowledge."

the new voices:

Today, John Platt, professor of physics at the University of Michigan (in *The Step to Man*): "I think mankind is showing a new level of will and purpose and design, a new feeling that he is the one responsible for himself. . . . We used to think of ourselves as orphans in the world. Now we discover that we are children of the universe, that it has been creating and supporting us for a long time and can go on doing so. We were meant to be here, so to speak.

"We thought we were disinherited. Now we discover that we have been given power and resources beyond imagining—the power of the sun itself—to do what we want with.

"We thought we were helpless, bounded by our animal inheritance, or by the darkness of our twisted subconscious, to irredeemable social organizations or to irrational follies and wars. Now we discover it is culture that shapes our minds and actions, and that better education can lead to better actions. . . . We will move, if we survive the strain, to a wealthy and powerful and coordinated world society reaching across the solar system, a society that might find out how to keep itself alive and evolving for thousands or millions or billions of years, a time as long as all of evolution past. . . . It is a quantum jump. It is a new state of matter. The act of saving ourselves, if it succeeds, will make us participants in the most incredible event in evolution. It is the step to Man."

Today, scientist-author Arthur Clarke, who sees (in *Profiles of the Future*) an even more stupendous vista: "Not until all these [brilliant b l u e-white stars] h a v e flamed through their incandescent youth, in a few fleeting billions of years, will the *real* history of the universe begin.

"It will be a history illuminated only by the reds and infra-reds of dully glowing stars that would be almost invisible to our eyes; yet the somber hues of that all-but-eternal universe may be full of color and beauty to whatever strange beings have adapted to it. They will know that before them lie, not the millions of years in which we measure the eras of geology, nor the billions of years which span the past lives of the stars, but years to be counted literally in trillions.

"They will have time enough, in those endless eons, to attempt all things, and to gather all knowledge. They will not be like gods, because no gods imagined by our minds have ever possessed the powers they will command. But for all that, they may envy us, basking in the bright afterglow of Creation; for we knew the universe when it was young."

Anticipating the modern view years ahead of his time was Sir Arthur Eddington (in *Space, Time and Gravity*) ". . . Where science has progressed the farthest, the mind has but regained from nature that which the mind has put into nature.

"We have found a strange footprint on the shores of the unknown. We have devised profound theories, one after another, to account for its origin. At last, we have succeeded in reconstructing the creature that made the footprint. And lo! it is our own."

Today, too, we have the words of Sir Julian Huxley (as quoted in *Science Year 1966*): "The evolution of this planet as a unit in the cosmic process has been going on for perhaps five billion years. Life was evolved here after about half of this huge span of time, and has itself been evolving during the latter half of the period. . . . We, like all other living organisims and all other features of the earth, are products of this process of evolution. We men belong to the latest dominant type to be produced, and are now responsible for the future evolution of the planet. . . . We are privileged to be living at a crucial moment in the cosmic story, the moment when the vast evolutionary process, in the small person of enquiring man, is becoming conscious of itself."

Still more pointedly, we have been told by Teilhard de Chardin (in *Phenomenon of Man*): ". . . There is for us in the future, under some form or another, at least collective, not only survival but *super-life*."

What all these voices are talking about is a life-force not at all alien to the universe but co-extant with it —a life-force of which we are the spearhead, from which we shall derive the benefits and for which we must now assume the full responsibility.

An old idea of life was matter which took on nourishment, grew and reproduced itself. Now, we know life to be a flow system, building environment, acquiring mobility, heightening complexity, increasing consciousness and collectivising, possibly cephalising, a superstructure for intensifying consciousness. The growth of inwardness is the most significant thing about life's newest model—man—and his conscious thought may allow him to imitate life now by building patterned circuitry into electronic brains far more complex than his own. In any case, he has been handed the reins and is in charge until he abdicates as charioteer or until the end of time.

Weary and confused as we may be, we are now told by the new voice of science that we have to shoulder the whole universe and the whole complex pattern of evolution from this moment on, with full responsibility for its continuance.

Perhaps the most terrible thing of all is that we appear to have a choice: We can work toward great goals, an exalted condition, or we can let the whole thing drop. But at least today's scientists, unlike their predecessors, are not moaning about fate, the hostility of the universe or the impotence of mankind.

QUIZ

KFS

Early paper making was a laborious hand process which yielded only pounds a day. Today's machines can produce tons.

It's 'only' paper

by John and Molly Daugherty

YOU'LL soon be throwing your underwear in the waste basket instead of the clothes basket. Already a man can buy paper swimming trunks for a dollar. A woman can buy a paper shift (a dress) for a dollar and up. And your doctor's clean disposable jacket probably costs him about sixty cents.

We aren't the first to wear paper, however. The Polynesians made Tapa "cloth," Deluwang paper of the East Indies, from the scraped and beaten bark of the paper mulberry tree *Broussonetia papyrifera*.

What else is paper news for you?

1. The amount of paper we use seems to indicate our standard of living. The nation that uses the most per capita is
   a. The United States
   b. Denmark
   c. Great Britain

2. Paper was first made from bamboo and rags at the beginning of the Christian era (105 A.D.) by the
   a. Arabs
   b. Egyptians
   c. Chinese

3. The early use of watermarks on paper and especially the reasons for using them are obscure. Apparently, however, the intent in the Middle Ages was to
   a. Show the artistic talent of the maker
   b. Serve as symbols of religious significance
   c. Indicate a trademark

4. Although cotton and linen fibers are still used for making some paper, wood is the main source of the cellulose for the bulk of the paper produced. The method of pulping wood that yields the smallest percent of pulp from raw wood is the
   a. Chemical method
   b. Semichemical method
   c. Mechanical method

5. The process most extensively used in preparing paper is the
   a. Sulfite chemical
   b. Sulfate chemical
   c. Semichemical

6. Rag content papers today vary from 25 to 100 percent rag. You are most likely to encounter 100 percent rag content paper in
   a. Newsprint
   b. Shopping bags
   c. Paper money

7. Paper bags appeared about
   a. 100 years ago
   b. 1,000 years ago
   c. During the 16th century

8. The largest percentage of paper consumed in the United States is for
   a. Printing and publishing
   b. Manufacturing converted products
   c. Other purposes

9. Origami, common in Japan since ancient times, is a
   a. Festival in which participants wear paper festoons
   b. Paper-folding skill
   c. Calligraphy on oriental paper

10. Paper is a felted or matted cellulose fiber. There are substitutes, of course. Of the following materials, the only one that is really paper is
   a. Vellum
   b. Parchment
   c. Glassine

Answers:

1—a The United States. Canada is second. Denmark, Sweden, Great Britain, and the Netherlands are all high in paper consumption per capita.

Americans use nearly a quarter of a ton of paper apiece every year. Several years ago the Russians used only 34.5 pounds of paper per capita annually, and the Africans, only four pounds, although Africa has the greatest forest areas.

2—c Chinese. Ts'ai Lun, later honored as the household god of papermakers, made the first paper. The process spread to Japan and Korea around 600-615 A.D. When the Arabs attacked Samarkand in 751, they captured some of the Chinese papermakers and soon learned the skill. The process reached Spain around 1150 and through the Spaniards got to Mexico before it reached North America before the Revolution. Our first paper mill was in Germantown (now part of Philadelphia) in 1690.

3—b Serve as symbols of religious significance. But watermarks indicating sizes of paper molds and other information may have been used as a sign language for workmen who couldn't read.

In early times thousands of different kinds of watermarks were used, including faces and human figures, birds, animals, fish, flowers, and so on. Today most watermarks are merely trademarks of the paper maker or the user, as in advertising.

4—a Chemical method. The sulfite chemical process cooks the wood chips

in an acid medium, whereas the sulphate process cooks the chips in an alkaline medium. The yield is only about 50 percent by these methods. Mechanical methods using ground wood by pressing the wood against a wet grindstone yields as much as 95 percent. Semichemical methods use mild chemical action and mechanical steps. They yield 75 percent or more.

5—b Sulfate chemical, also known as the kraft process. *Kraft* is Swedish for strength. One advantage of this process is its applicability to nearly all kinds of wood. A disadvantage is the low yield compared with that of the newer semichemical processes, in which a mild chemical action softens the wood before it is mechanically disintegrated into pulp.

6—c Paper money. Paper that is 100 percent rag has great durability, strength, fine texture and excellent qualities for writing and erasure. Paper with less rag content has these properties to a lesser degree.

The *New York Times* prints one 100 percent rag edition for permanence.

7—a One hundred years ago. If you'd lived before then, you'd have had to go to the store with your own container for sugar, flour and coffee, for staples were delivered in bulk.

The brown paper bags you carry home from the supermarkets are kraft paper.

8—b Manufacturing converted products, such as milk containers, towels, diapers, napkins, hospital bedding, and other single-use items. Only 30 percent of our paper goes for printing and publishing, and 25 percent for miscellaneous purposes, aside from the 45 percent for converted products.

9—b Paper-folding skill. *Ori* means fold, and *gami (kami), paper.* Origami is the old art of paper sculpture —folding paper skillfully into shapes of birds, flowers, and so on. We also use paper-folding in teaching to illustrate special concepts and mathematical relationships and in occupational therapy to improve hand and finger coordination in the motor-handicapped.

10—c Glassine, a thin, transparent paper. Manufacturers make glassine from wood pulp processed by the sulphite method. Machinery beats the pulp longer than for other paper and then calenders (rolls) it lightly. Workmen dampen the paper during the rewinding and allow it to stand awhile to absorb water evenly. The glassine paper finally passes through the steam-heated super-calenders to give it a high gloss and improve its transparency. It is used for windows in envelopes.

Parchment and vellum are animal products—parchment from split sheepskin and vellum from calfskin, goatskin or lambskin.

Score yourself

9—10 right—You've beaten the others to a pulp!

4— 8 right—You probably know that your sheepskin isn't just another piece of paper.

0— 3 right—Don't let a paper quiz foil you.

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LETTERS

Without innuendoes

Let me compliment you on an excellent job on the article "Looking for the Monster" (Jan. '67). I was throughly surprised to find that your treatment was entirely fair without the usual tongue-in-cheek innuendoes. Further, your facts and statements were quite accurate.

ROY P. MACKEL
Associate Professor
The University of Chicago

Dr. Mackal is a member of the Loch Ness Phenomena Investigation Bureau Ltd., a group dedicated to discovering whether or not there is a large and unknown animal living in Scotland's Loch Ness—Ed.

UFO's

I would like to congratulate you on a fine job of presenting a one-sided argument on UFO's (UFO's—What A New Investigation May Reveal, Dec. '66). It was apparent that even though the author, Daniel Cohen, didn't say that Flying Saucers don't exist, that he thought it. The author quoted people, or wrote things which are not true. . . .

The article says, ". . . and all saucer organizations have a vested interest in having every sighting turn out to be a spaceship." This just isn't so. He mentions NICAP (National Investigations committee for Aerial Phenomena) but if he read the publication put out by NICAP, he would know that the organization expects many of the sightings to be conventional aircraft or natural phenomena.

The article also says that the Air

Force is not interested in UFO's. Then how come in 1959, the Inspector General of the Air Force wrote to every Air Force Base Commander and told them that, "Unidentified flying objects—sometimes treated lightly by the press and referred to as flying saucers—must be rapidly and accurately identified as serious USAF business. . . ." Don't tell me that this sounds like the Air Force has not taken UFO's seriously.

ALAN SCOTT KOSSOFF
Roslyn Hts., N.Y.

A lot of space in your article is used to clear the Air Force of "conspiracy charges," yet it must be admitted that due to past performances this view is somewhat justified, although I think it is unfair. The Air Force tends to expose cases which they have solved and to dismiss unknowns.

In connection with scientists, would it have hurt to mention a few who seem to favor the extraterrestrial theory? Notice that I emphasize theory. A few "good" UFO pictures to compliment the ones which you showed might also have added to the article.

JAMES S. TAYLOR
Blacksbur, Va.

I suggest you get more accurate information on the UFO problem before you expect informed readers to digest your material. Now here are just a few of the areas of inaccuracy, in your account:

You say that Officer Zamora was the sole witness to the New Mexico UFO landing. Hundreds of persons all over the south side of Socorro heard the same roar Zamora heard as the UFO descended. In addition a local service station manager reported that an unidentified tourist who stopped at his station complained that a strange craft almost took the roof off his car at about the same time.

The two officers said the ground was normal temperature while some branches were charred and a few branches were still warm and smoking.

You said that "a single spaceship" has never been tracked on radar. If what you meant is that a good, hard-to-explain UFO has never been tracked on radar then you are seriously mistaken.

Your smug claim to objectivity is not demonstrated in your article. You owe your readers an honest debt.

RAY D. STANFORD
Phoenix, Ariz.

The December article on UFO's was interesting and resourceful. However, the author does not give equal representation to the organizations that believe UFO's are spaceships, particularly the National Investigations Committee on Aerial Phenomena. The reader, in this way, would have been given a better understanding of UFO's and could judge whether the Air Force is conspiring or if the organizations, are misinterpreting the facts.

STEPHEN SMITH
Lake Parsippany, N.J.

Having read your biased, unfactual and uninformed article on UFO's I am compelled to answer you. Here are just some of your errors.

UFO is not pronounced "U-Foo". It is either called by the letters U.F.O. or pronounced "U-Foe." Furthermore, the UFO "mystery" did not begin nearly twenty years ago, it began

over 20 years ago. During World War II pilots frequently sighted them flying along in formation. They were called Foo-Fighters by our pilots.

Regarding your statement about the "small but vociferous minority" who believe . . . etc. . , why didn't you print the findings of the latest Gallup Poll? It was found that more than five million Americans have seen something they believe to be a flying saucer. And about half of the U.S. adult population believe that these objects are real and not just a figment of the imagination.

Your statement that there is no Air Force secrecy or censorship in regard to UFO's is disputed by the Air Force's own regulation. Service personnel and employees are forbidden to discuss UFO sightings.

Just like an Air Force spokesman, you state that in the Zamora sighting the radar in the area picked up no strange craft. However, just the same as the Air Force, you are unaware that the only radar which covered that area was not in operation at the time!

You state that Zamora was not wearing his glasses, and that his superior found the burned vegetation was cold. Actually Zamora had his glasses on while he watched the UFO. It was after the vehicle started to rise that Zamora ran in fear that it might explode and bumped into his car, whereupon his glasses fell off. As far as the burning vegetation goes, the other officer testified that the ground was still smoking when he arrived.

RALPH RANKOW
New York, N.Y.

It is obviously impossible for me to respond in detail to all the above criticisms and the many, many others that I have received. I have read all the letters carefully, and reread my own article, and found two points of substance where I was wrong.

1. As Mr. Rankow points out, U-F-O is pronounced U-foe, not U-foo.

2. It seems that something (although Mr. Rankow and Mr. Stanford seem to disagree as to what) was reported to be warm and smoking shortly after the strange craft Sgt. Zamora said he saw, took off.

For these errors I apologize. For all the rest of the criticism, I have rechecked my sources and am content to stand with the article as it was originally written. I suggest my critics recheck their sources.

DANIEL COHEN

How old?

In the article "The Man Dr. Leakey Dug Up" (Nov. '66) the author Jeanne Reinert states "textbooks today favor an ancestry of 400,000 to 800,000 years, based on carbon-14 tests. . ."

Is there perhaps an error in attributing this estimate to carbon-14 testing? Is it possible to go much beyond 25,000 years by means of that procedure?

ROBERT H. RICHARDS
Akron, Ohio

In writing about the uniqueness of Olduvai Gorge, the author states, "Nowhere else on earth is there a site that chronicles man's early history in a known sequence." This is wrong. Alamira Cave, near Santander, in Spain, is one of several examples of such sites, and perhaps the best outside of Africa.

In assigning a date to the Acheulian tool assemblage, you are very much wrong in saying they should be "attributed to the period of time 75,000 to 150,000 years ago." It is still too early to assign a definite chronologic date to early Acheulian, but 400,000 years would be a much safer figure than what the author proposes.

The author grossly errs in saying that "five years ago, evidence was available showing only that man had been in America for 5,000 years." The number of archaeological sites in the New World which exceed 5,000 years in age and which have carbon-14 evidence to validate their antiquity is very high, and much of this information was known five years ago and more.

R. ROBERT MCCABE
Key West, Fla.

Yes, it is erroneous to attribute a range of 400,000 to 800,000 years to carbon-14 dating techniques; they do not extend beyond 60-70,000 years. Only potassium-argon dating methods would give results in the longer range.

The uniqueness of Olduvai Gorge has been mentioned by many reputable sources. Sites in Europe and elsewhere are not nearly as old.

The matter of the Acheulian tool age is a matter of interpretation. Some sources of information attributed the 150,000-year age to these tools.

Mr. McCabe may well be correct about the time of the American discoveries. The five year period was advanced by Dr. Leakey during my interview with him.

JEANNE REINERT

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House Planning & Interior Design
Mason Painting Contractor
Reading Arch. Blueprints
Review in Arch. Design & Practice
Review of Mech. Systems in Buildings

ART
Amateur Artist
Commercial Art
Commercial Cartooning
Illustrating with Options:
—Magazine
—Advertising Layout
—Illustration
Interior Decorating
Oil Painting for Pleasure
Show Card & Sign Production
Show Card Writing
Sign Painting & Designing
Sketching & Painting

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Automobile Body Rebuilding & Refinishing
Automobile Electrical Tech'n
Automobile Engine Tune-Up
Automobile Technician
Automotive Mechanic
Diesel-Gas Motor Vehicle Engines

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Business Administration
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Industrial Psychology
Magazine & Newspaper Advertising
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Marketing
Marketing Management
Marketing Research
Modern Executive Management
Office Automation
Office Management
Production Management
Programming for Digital Computers
Programming the IBM 1401 Computer
Programming the IBM SYSTEM/360 Computer
Purchasing Agent
Retail & Local Advertising
Retail Business Management
Retail Merchandising
Retail Selling
Systems and Procedures Analysis

CHEMICAL
Analytical Chemistry
Chemical Engineering
Chemical Engineering Unit Operations
Chemical Laboratory Tech.
Chemical Process Operator
Elements of Nuclear Energy
General Chemistry
Instrumental Laboratory Analysis

CIVIL ENGINEERING
Civil Engineering
Construction Engineering Technology
Highway Engineering Tech.
Principles of Surveying
Reading Highway Blueprints
Reading Structural Blueprints
Sanitary Eng'r'g Technology
Sewage Plant Operator
Structural Engineering Tech.
Surveying and Mapping
Water Works Operator

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Architectural Drafting
Design Drafting
Drafting Technology
Electrical Drafting
Electrical Engineering Drafting
Electronic Drafting
Introductory Mechanical Drafting
Mechanical Drafting
Pressure-Vessel and Tank Print Reading
Sheet Metal Layout for Air Conditioning
Structural Drafting

ELECTRICAL
Electric Motor Repairman
Electrical Appliance Servicing
Electrical Contractor
Electrical Engineering (Power option or Electronic option)
Electrical Engineering Tech.
Electrical Instrument Tech.
Industrial Electrical Tech.
Power Line Design and Const.
Power Plant Operator (Hydro or Steam option)
Practical Electrician
Practical Lineman
Reading Electrical Blueprints

ENGINEERING (Professional Refresher Courses)
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Italian Spanish

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Industrial Foremanship
Industrial Supervision
Modern Woman as a Supervisor
Personality Development
Personnel-Labor Relations
Supervision

MATHEMATICS
Advanced Mathematics
Mathematics and Mechanics for Engineering
Mathematics and Physics for Technicians
Mathematics and Physics for Engineering
Modern Elementary Statistics

MECHANICAL
Aircraft & Power Plant Mech.
Fortran Programming for Engineers
Hydraulic & Pneumatic Power
Industrial Engineering
Industrial Management for Engineers
Industrial Engineering Tech.
Industrial Instrumentation
Machine Design
Mechanical Engineering
Quality Control
Safety Engineering Tech'l'gy
Tool Design
Value Analysis
Vibration Analysis and Control

PETROLEUM
Natural Gas Production & Transmission
Oil Field Technology
Petroleum Production
Petroleum Production Eng.
Petroleum Refinery Operator
Pipeline Engineering Tech.

PLASTICS
Design of Plastic Products
Plastics Technician

PLUMBING, HEATING, AIR CONDITIONING
Air Conditioning
Air Conditioning Maintenance
Domestic Heating with Oil & Gas
Domestic Refrigeration Heat'g
Heating & Air Conditioning with Drawing
Industrial Air Conditioning
Industrial Heating
Pipe Fitting Plumbing
Plumbing & Heating
Plumbing & Heating Estimator
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning

PULP AND PAPER
Paper Machine Operator
Paper Making Pulp Making
Pulp & Paper Engineering
Pulp & Paper Making

SALESMANSHIP
Creative Salesmanship
Real Estate Salesmanship
Sales Management
Salesmanship

SECRETARIAL
Clerk-Typist Commercial
Engineering Secretary
Legal Secretary
Medical Secretary
Professional Secretary
Shorthand Stenographic
Typewriting

SHOP PRACTICE
Drill Operator
Foundry Practice
Industrial Metallurgy
Lathe Operator
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Milling Machine Operator
Multicraft Maintenance Mechanic
Practical Millwrighting
Reading Shop Prints
Rigging
Tool Engineering Tech'l'gy
Tool Grinder Toolmaking
Turret Lathe Operator
Welding Engineering Tech.
Welding Processes

STEAM AND DIESEL POWER
Boiler Inspector
Industrial Building Engineer
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Engineering

TEXTILES
Carding
Carding and Spinning
Dyeing & Finishing
Loom Fixing Spinning
Textile Designing
Textile Mill Supervisor
Textile Technology
Warping and Weaving

TRAFFIC
Motor Traffic Management
Railway Rate Clerk
Traffic Management

TV-RADIO-ELECTRONICS
Color Television Principles & Servicing
Communications Techn'l'gy
Electronic Fundamentals
Electronic Fundamentals (Programmed)
Electronic Fundamentals with Electronic Equipment Training
Electronic Instrumentation & Servo Fundamentals
Electronic Principles for Automation
Electronics and Applied Calculus
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Industrial Electronics
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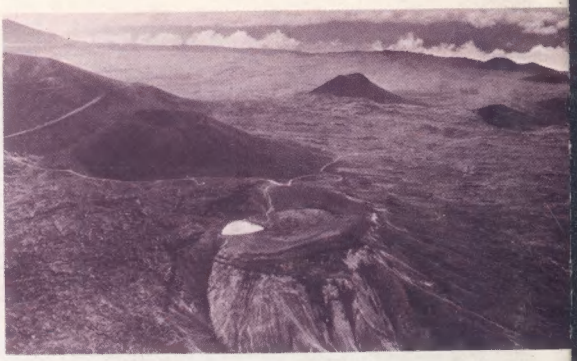
The animal that acts human

MONKEYS, baboons and other assorted simians so closely resemble man that the animals are invaluable to research concerned with finding solutions to man's problems from surgery to genetics.

The chimpanzee above puckers his lips while having his ears examined at Delta Regional Primate Research Center. Scientists at the center are doing extensive experiments for treatment of birth defects, neurosensory responses and sociological behavior. Dr. Arthur J. Riopelle, center director, points out that major diseases couldn't have been conquered without the help of monkeys. "Yellow fever was one . . . the Salk vaccine for polio depended on the monkey liver for its production and the monkey remains the test animal for vaccine potency." And the chimpanzee preceded man into space.

In this issue . . .



Nestled high on an extinct volcano, on the island of Hawaii is a small, heart-shaped lake. Probing the sediments on the bottom of this lake geologists have been able to "read" the history of the island, all the way back to the Ice Age. See the article appearing on page 78.

Ernest Wildhaber invents things that we all use but rarely see or think about—gears. He invented the gear which transmits power from the engine to the rear wheels of every American passenger car. In 42 years he has patented 300 gears. See Inventor of the Month, page 23.

America's leading science explainer, Dr. Isaac Asimov tells all about cosmic dust, and how the stars and galaxies were formed. See "Please Explain", page 80.

Papermaking, once a laborious hand process is now one of the world's biggest industries. The amount of paper a nation uses is a fair indicator of its degree of advancement. On page 87 you will have a chance to test your knowledge of paper.

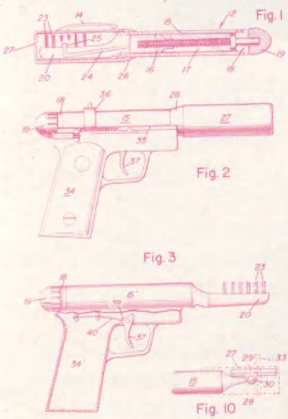
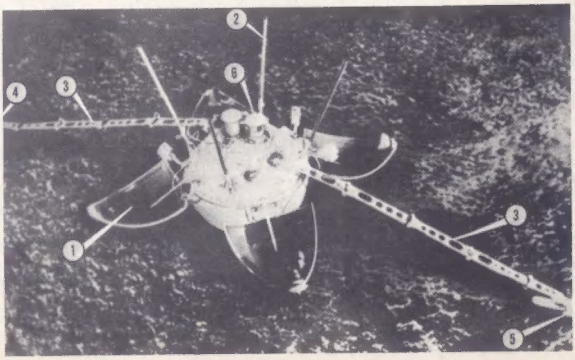


Fig. 1

Fig. 2

Fig. 3

Fig. 10

Junior won't brush his teeth? Perhaps this gun-toothbrush will persuade him. It is only one of the thousands of suggestions that have been offered for bathroom improvements. Page 72.

The newest wrinkle in the Soviet lunar exploration program is an instrument package that can drive a rod into the moon's surface. They landed such a package late last year; for that report see page 33.